CHEMICAL ENGINEERING
with CHEMICAL & METALLURGICAL ENGINEERING

ESTABLISHED 1902 SEPTEMBER 1948 SIDNEY D. KIRKPATRICK, Editor

Front and Center

How about your tickets for the Chicago Chem Show? It's time to make your reservations if you want a front row seat at this biennial classic of chemical engineering progress. Two years ago more than 45,000 were checked through the gates at the Chicago Coliseum for the last National Chemical Exposition. Next month we predict that many more will attend the well-organized program of chemical conferences and joint meetings with the technical societies. And, if you can make it, be sure to bring your production problems with you for there will be plenty of opportunities to exchange experiences with some of the nation's top specialists in process-equipment and new-product developments.

Typical of the tempo and purpose of the Chicago Show will be another of its valuable features—the Chemical Trail Blazers. Here, in a special section set off from the other exhibits, will be displayed some of the results of recent research that have not yet been translated into commercial practice. Thus you will have an opportunity to study and appraise advances being made on many fronts. And, don't forget that often the biggest gains can come from the ideas you glean from others outside your own specialized field or industry.

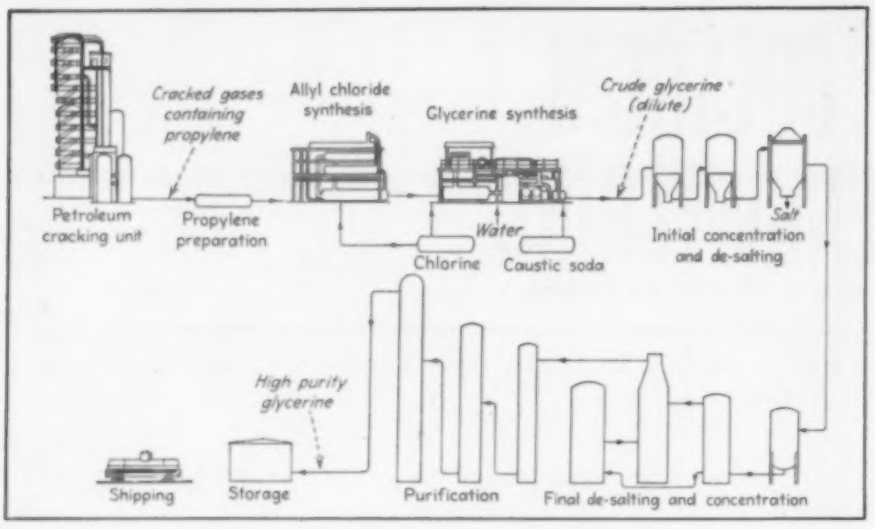
Chicago itself is both a front and center of industrial progress. It has long been the gateway to the great central market of the Midwest. Today that market is richer and more prosperous than ever before in its history. The prairie empire is helping to feed the world—and is being paid handsomely for it. In turn it is buying more goods and equipment and thus helping itself to build a better balance between industry and agriculture.

Other midwestern metropolises are becoming even more important as chemical centers. St. Louis, Detroit, Cincinnati, Minneapolis, Cleveland, Kansas City, and Indianapolis—each have their stories of recent chemical progress which we are pleased to publish in this month's "*Chem & Met*" Report on the Midwest Industrial Economy. Study of these brief but fact-filled summaries will reveal many challenging and surprising trends. So, too, will the articles by Hilbert, Egloff and Porter—each reporting on technological progress in great basic industries of the Central States—chemurgy, fuels and pulp and paper.

During and since the war, there has been an accelerating migration of many process industries. From the bare statistics it would often appear that the great regional shifts have been to the South and Far West at the expense of the older industrial areas. Yet more detailed studies usually show that these moves are made by the larger mass-production plants seeking some special advantages in labor or raw materials to offset higher transportation costs. Meanwhile there is a steady crop of newer and smaller industries to serve the increasing needs of consumer markets such as those in North Central States.

The Midwest's is far from a mature economy. There are still opportunities—great and small—for the chemical trail blazers and the chemical engineers and industrialists who follow hard on their heels. May we suggest that you let us know where to send your tickets for the Big Show that starts in Chicago on October 12?

Sidney D. Kirkpatrick



1948 AWARD WINNING

CHEMICAL ENGINEERING ACHIEVEMENT

Glycerine From Petroleum

J. V. Hightower
Southwestern Editor
Chemical Engineering

PRODUCTION of synthetic glycerine from propylene, a refinery product, is now under way at the Houston plant of Shell Chemical Corp. Thus is another milestone passed in the onward march of chemical engineering. In mid-September, just one year after groundwork began, Shell proudly took the wraps off its new and still expanding plant—the world's first commercial installation turning out synthetic glycerine. A two-day round of ceremonies and sight-seeing at the new Houston plant marked the occasion.

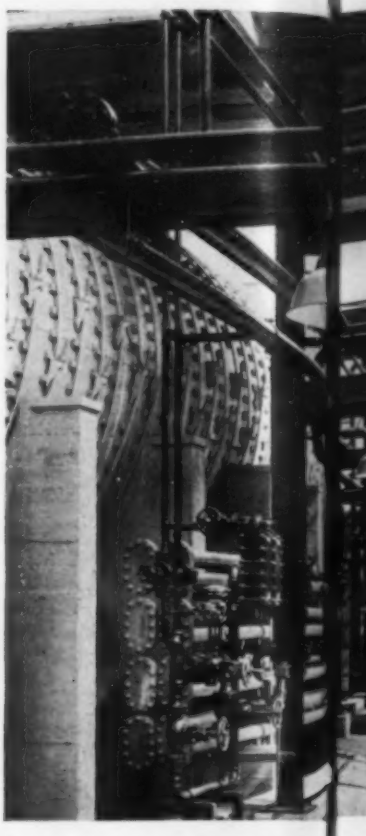
The big $8 million unit stands as a monument to the vision, insight and perseverance of the Shell researchers, who were determined to take glycerine out of the byproduct category. An account of their work is contained in "Synthetic Glycerine From Petroleum," a paper by E. C. Williams and his associates of the Shell Development Co. This paper was presented at New Orleans on Dec. 3, 1940, before a meeting of the American Institute of Chemical Engineers. It was published in this magazine (see *Chem. & Met.*, Dec. 1940, pp. 834-838, and *Chem. & Met.*, Jan. 1941, pp. 87-89).

Construction of the unit at Houston has great significance. For one thing, the price of glycerine will be stabilized; its price will fluctuate far less widely than it has in the past. The achievement means that we are no longer entirely dependent on the soap and fatty-acid industries for our supply of this important commodity.

Thanks to Shell's feat the United States is unlikely to be as pinched for glycerine in any future war as it was pinched during the last conflict. It may be recalled that during World War II glycerine was under allocation.

The unit at Houston comes into operation at a highly opportune time. Because of heavy demands for glycerine in the manufacture of protective coatings, foods, tobacco products, explosives, cosmetics, pharmaceuticals and other products, consumption of

Shell's new synth ce

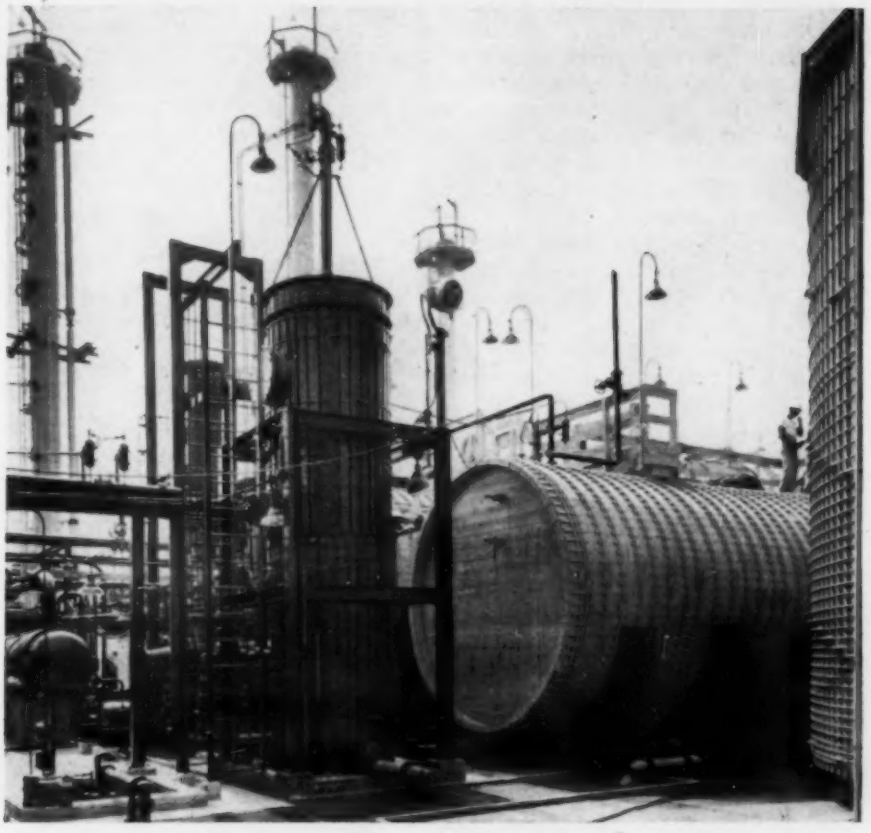


Perspective through a pipeway a ment

These overload relays protect equip

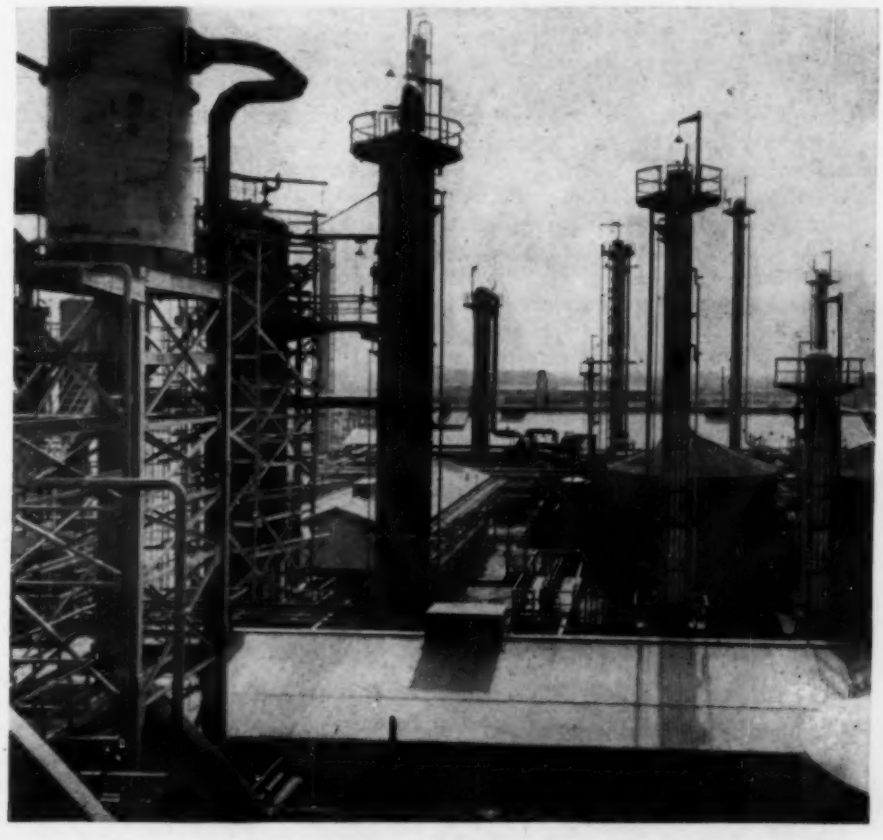
v synthcerine plant, the first of its kind, goes on stream.

ipeway a ment used in making glycerine.



Part of Shell's new plant at Houston, where glycerine is made from propylene.

protect quipment at the new installation.



Towering columns surround storage tanks in midst of synthetic glycerine unit.

glycerine has risen to around 200 million pounds per year. The supply is tight. The price last month for USP glycerine in car lots ranged between 39 and 40 c. per lb. Although the capacity of the glycerine plant at Houston has not been disclosed, the size of the equipment strongly indicates that the production from the plant is an appreciable percentage of the current national production from byproduct sources.

Any necessity to increase the manufacture of synthetic glycerine can easily be met, so far as raw materials are concerned. The basic hydrocarbon used in the synthesis is propylene, which is produced in large amounts in the course of petroleum refining.

At Houston the glycerine unit utilizes propylene piped to the Shell Chemical plant from the adjoining refinery of Shell Oil Co. In the chemical plant the propylene, received in a mixture with other hydrocarbons, is separated from those materials and goes to the glycerine unit in a high degree of purity. High purity is important in the subsequent processing and avoids the production of unwanted byproducts.

Chlorinating Propylene

The manufacturing process consists of several steps, the first of which is the reaction, at high temperature, between propylene and chlorine. The chlorine is obtained as a liquid moved through a pipeline from the nearby new electrolytic plant of Diamond Alkali Co., which went into operation several months ago. The chlorine-propylene reaction results in the production of allyl chloride, the first intermediate. After being purified the allyl chloride is subjected to further processing in which chlorine, caustic soda and water are employed in the course of the glycerine synthesis.

Glycerine emerges from the synthesis phase of the operation as a dilute water solution containing sodium chloride. The next step is desalting and purification. The solution is pumped to multiple-effect evaporators, and from the last stage is withdrawn a concentrated glycerine-salt slurry. This is pumped to a settling tank from which the glycerine concentrate is removed and pumped to a system of evaporators where the glycerine is vaporized under reduced pressure. With the last traces of salt removed, the product undergoes the final purification and goes to a lined storage tank with a purity greater than 99 percent. The glycerine is marketed in 8-000-gal. aluminum tank cars.

The background of research against which stand the towers of the glycerine unit at Houston is broad and imposing. Shell Development Co. undertook the investigation of a commercially feasible synthetic glycerine process in the early Thirties, and culminated the effort on a pilot plant scale at Emeryville in approximately 1936.

Plant Planning

Construction of the plant at Houston resulted from a prophetic view of the future by the Shell organization. It was accompanied by a thorough job of market analysis on the long-range scale. Shell examined the new and increasing uses of glycerine and contemplated the rising demand in the light of wide annual fluctuations in the price of the product. The supply then, as now, came primarily from hydrolysis or saponification of oils and fats. Engineers, chemists, market specialists and executives of the organization were convinced that new applications of glycerine, particularly those connected with costly manufacturing processes, would be delayed unless glycerine prices became more stable.

E. C. Williams and associates of the Shell Development Co., in a paper before the American Institute of Chemical Engineers, New Orleans, Dec. 3, 1940, said, "Basically, the logical opportunity for a synthetic glycerine process should lie in the growth of uses for glycerine beyond the power of existing sources of supply, or on the desirability of having an alternative source as an influence in smoothing out such wide variations in production and price. The average selling price for C.P. glycerine over the years 1920-1940 as quoted in the trade press is about 16 c. per lb. During this period there have been three peaks; at 28 c. in 1920, at 32 c. during 1926 and 1927 and at 29 c. during 1937."

They also believed that if the price of glycerine could be stabilized, this would tend to increase the use of the commodity, perhaps to a point where the soap industry and other normal sources could not meet the demand. Also, they counted on the mounting production of alkyd resins to require greater quantities of glycerine, as has been the case.

In their paper in 1940 the authors presented in detail the variations from year to year in the supply, price and consumption of glycerine and declared that "Under these circumstances the opportunity for a synthetic process appears to lie in its power not only to stabilize prices but also to guarantee a virtually inexhaustible potential supply of high grade glycerine at a reasonable price. The realization of this fact will in our opinion tend to act as a stimulus to industrial developments leading to new uses of glycerine—developments which might never be embarked upon in the absence of such guarantees."

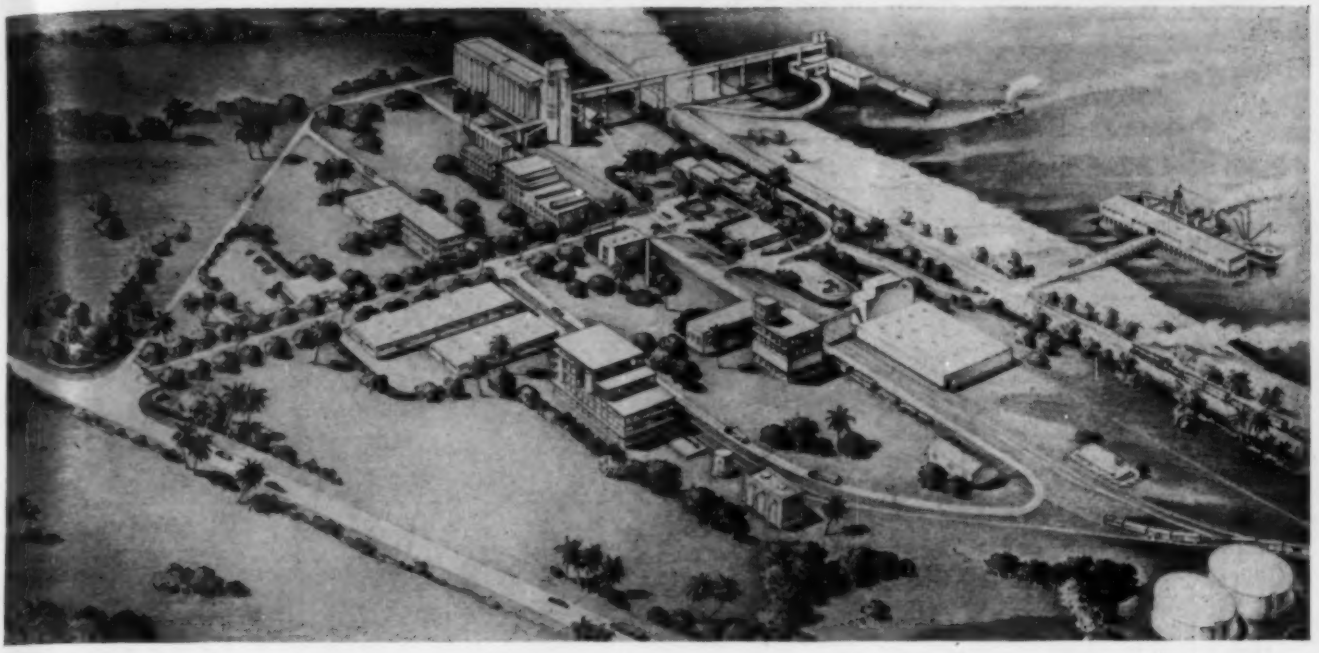
The commercial synthesis of glycerine had for many years been the objective of research along various lines. During World War I Germany produced 13,000 tons per year by a modification of the fermentation process for alcohol. This method, however, had serious drawbacks and is of no commercial significance today.

Results of work by the Shell research organization indicated that the best starting point for the manufacture of synthetic glycerine was allyl chloride. The problem of manufacturing allyl chloride from propylene had already been investigated as a part of the fundamental research previously carried out by Shell Development on the chlorination of petroleum-derived hydrocarbons, in general, and of olefins, in particular.

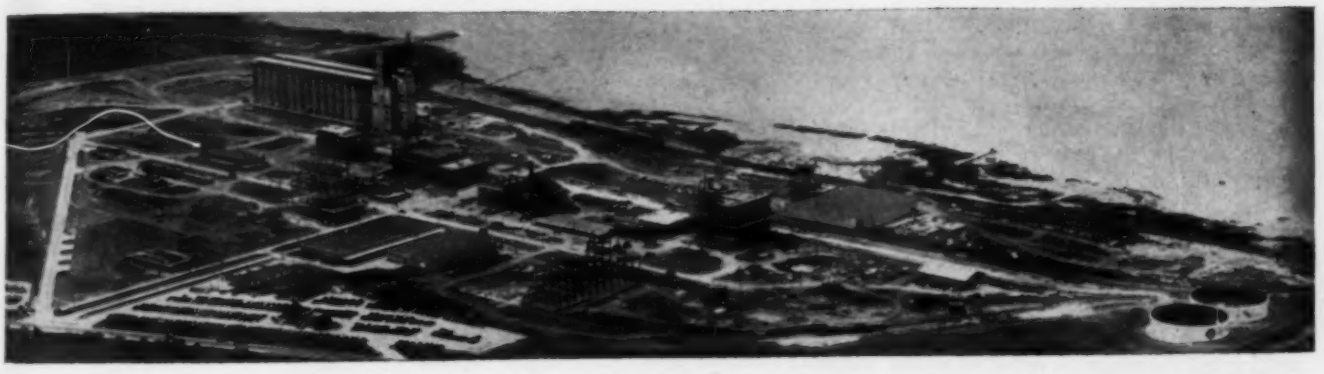
In the case of olefins, it was desired to determine the factors favoring the substitution of chlorine in the molecule, leaving the unsaturated bond unaffected, as opposed to the more usual addition reaction. For, if the former type of reaction could be made to proceed with propylene, the synthesis of allyl chloride would be achieved. The results of Shell's research proved that, with the proper control of temperature, pressure and reactant concentration, the substitutive chlorination of propylene to allyl chloride could be achieved in commercially attractive yields. This accomplishment has been hailed as an important contribution to organic chemistry.

Following the preliminary laboratory-scale examination of the production of glycerine from allyl chloride, a pilot plant was built and the long investigation was brought to a successful conclusion.

An important phase of the work concerned purification of the product. The authors of the 1940 paper said humorously, "In the early part of our work we produced some rather remarkable glycerines. They came in a wide variety of colors—yellow, brown, green, red—and odors—burned, caramel, pineapple, gingerbread, and even some hitherto undescribed and indescribable smells. Fortunately we have lost the secret of making these compounds and now produce what is to all intents and purposes the simple chemical entity 1,2,3—trihydroxypropane."



Architect's Dream . . .



. . . Becomes Reality

Architectural treatment of processing area buildings is going to make this plant more attractive, more efficient and safer.

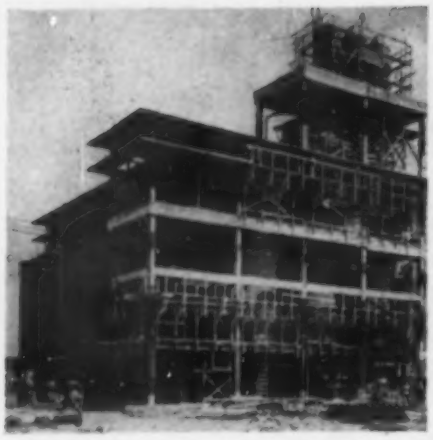
FRANK L. WHITNEY, PROJECT ARCHITECT

EXPECTED to be completed in early 1949, the new Corn Products Refining Co. plant at Corpus Christi, Tex., sets a new pattern in chemical processing plant design. It is believed to be the first major chemical processing plant in the United States that has taken maximum advantage of architectural treatment in processing areas. That it will be one of the most attractive plants in an industry where attractive plants are a rarity is perhaps less significant than the influence it may have on designers of future chemical facilities.

This plant will manufacture dextrose sugars, starches, high protein cattle feed and other products from milo to maize. It will utilize a new process developed especially for grain sorghum and never before used on a commercial scale. It is a large plant, covering hundreds of acres and costing in excess of ten million dollars.

The unique approach to the design problem for this mammoth new plant was formulated soon after Corn Products Refining Co. retained the H. K. Ferguson Co., industrial engineers and builders, for engineering and construction services. A high degree of cooperation between the owners and the designers was established, and both parties agreed at the outset to design a plant that would be not only 100 percent functional but also architecturally appealing. Representatives of both Corn Products and Ferguson were convinced that a chemical processing plant with "eye appeal" could be constructed without sacrificing process efficiency and without boosting the cost of construction.

In fact, with regard to cost, the opposite is true, a situation made possible by the ideal location of the plant site in the Corpus Christi area. This location resulted in the first major decision that affected the entire architectural approach. It was decided to use "open" type construction in every instance where it was not imperative for the process area to be enclosed. In addition to being more economical, the open construction approach has other advantages: it derives maximum benefit from the climate; it reduces fire hazards and fume conditions; and



Today. ▲ Tomorrow. ➡

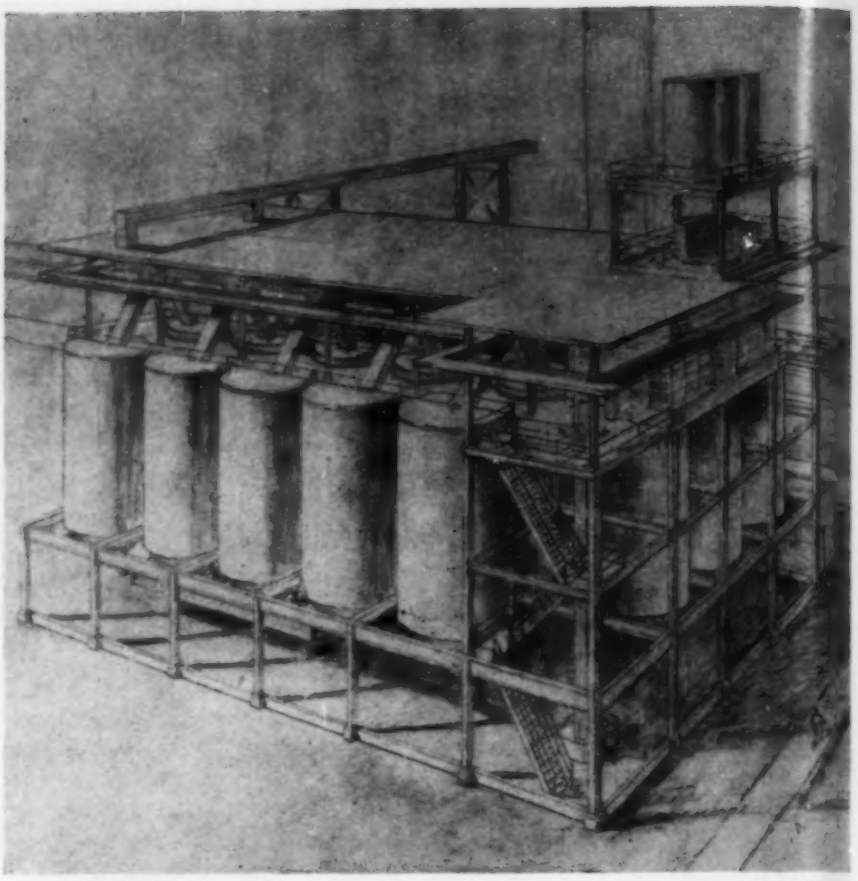
finally, it makes expansion and modernization easier and more economical because it eliminates the necessity of revamping entire buildings if equipment changes are in order.

Here's how the departure from past chemical plant design has affected one part of the Corn Products plant, the grain storage group. In existing plants, the entire head house, the tall part of the unit, is completely enclosed. In this new installation, approximately two-thirds of the construction above the top of the silo line has been eliminated. In fact, the only enclosed walls in this unit are bin storage walls. Due to the open areas on the grain elevator buildings, dust (which has always been a major fire hazard) has been greatly reduced.

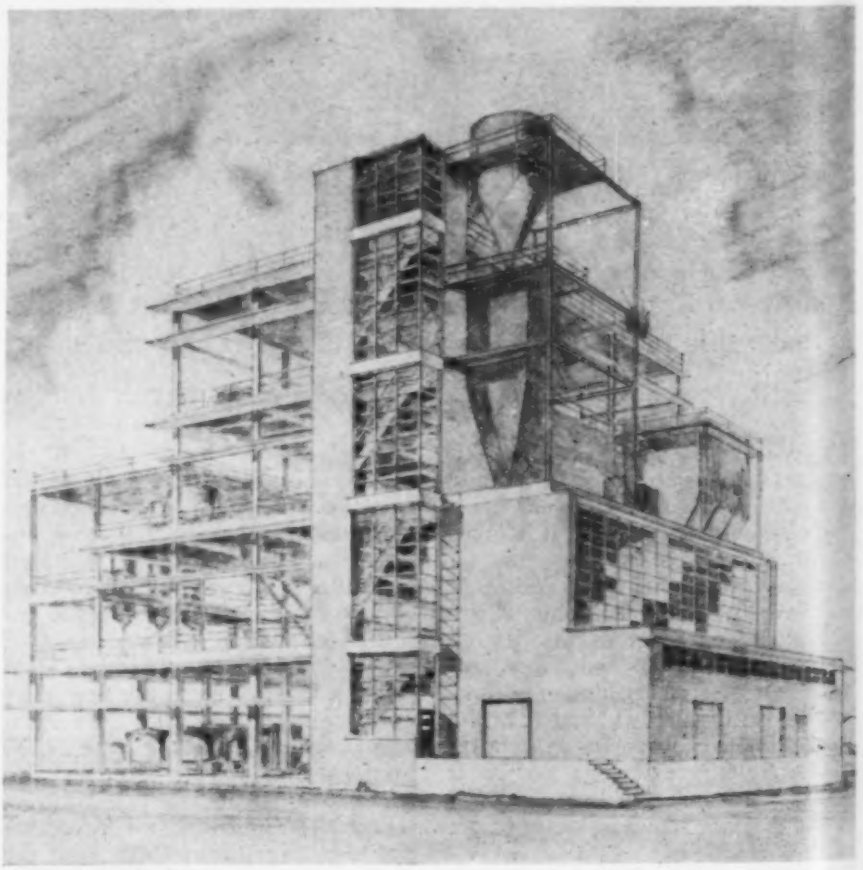
Another example that may be cited is the steep house. The most recently completed steep houses in the industry are completely enclosed buildings. Since unpleasant and sometimes-destructive gases are liberated in this phase of the operation, maintenance costs on these enclosed buildings have been unusually high. By opening up the buildings the maintenance problem is reduced greatly and personnel are given much better working conditions—all at an actual savings in construction cost.

Similarly, mill houses, feed houses, refineries and starch houses in corn processing plants have generally been enclosed structures. In each instance in this plant, Ferguson and Corn Products engineers have made concerted efforts to close up the products for processing, and open up the buildings. This will lead to a cleaner operation.

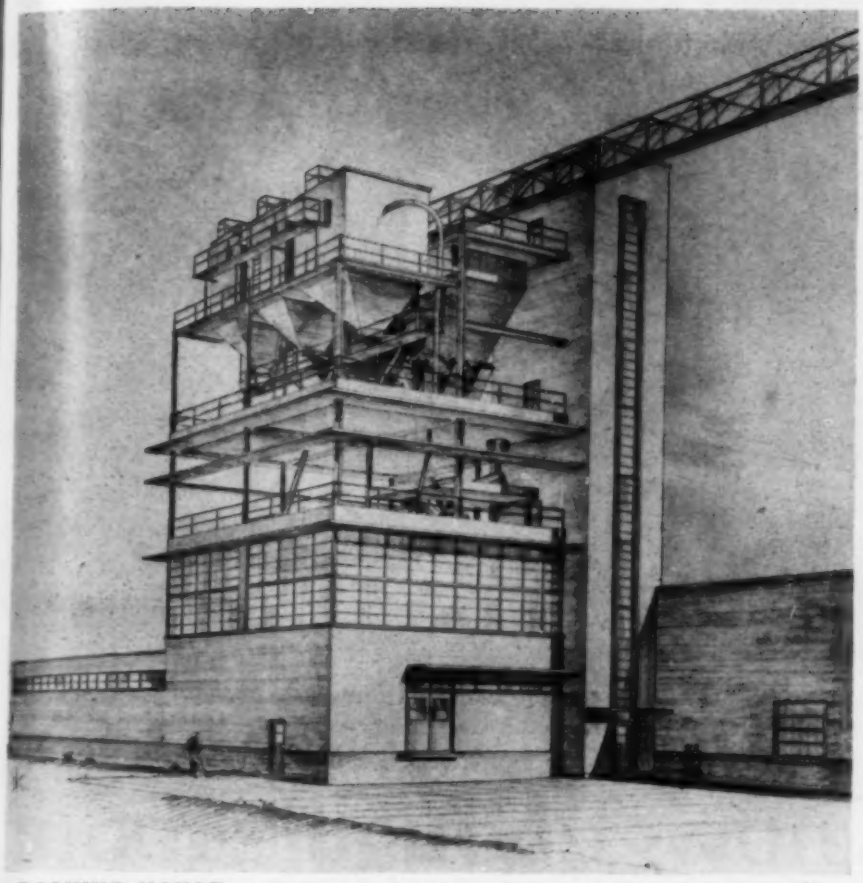
In the design of the sugar house, the only enclosed portion is the centrifugal spinning room on the second floor. This particular operation could not be closed up without enclosing an entire area. In the sugar and starch packing structure, the only enclosed portion is the bagging area, a result of the fact that all sources of contam-



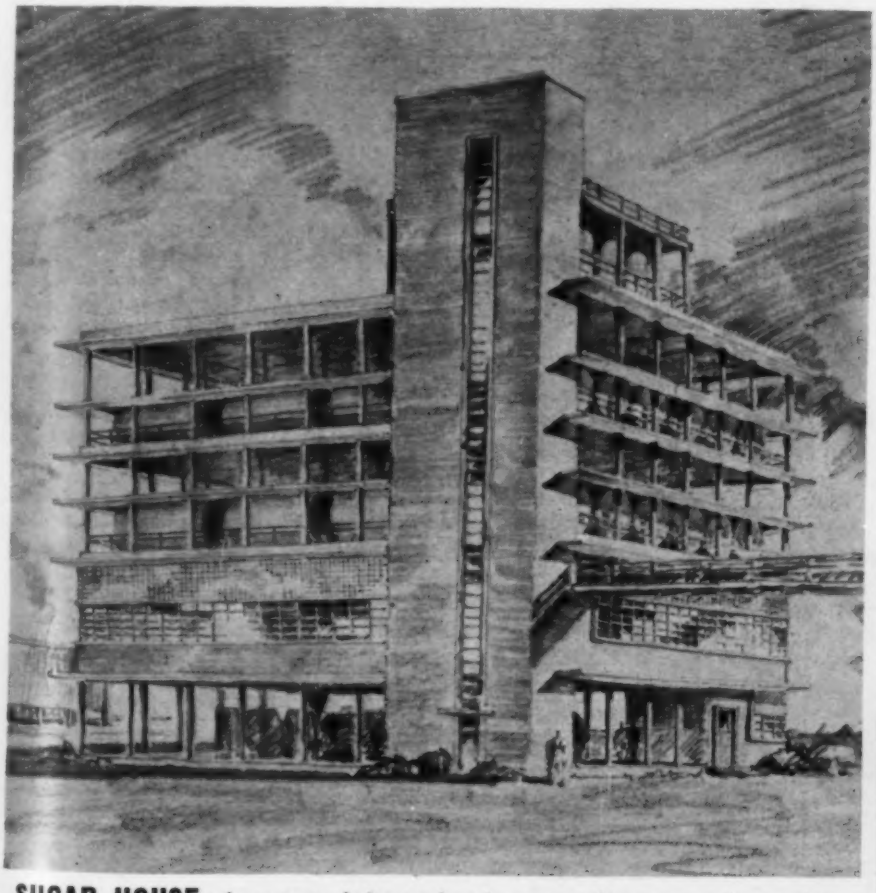
STEEP HOUSE where the second step in a Corn Products Refining Co. operation takes place. The building is going to look like this when it's finished.



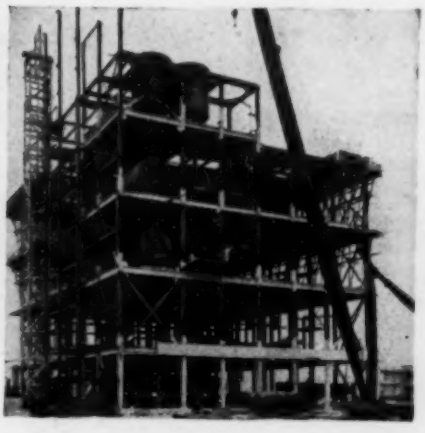
FEED HOUSE where part of the product is processed for animal feed. These sketches show only four of more than a dozen processing buildings now going up.



PACKING HOUSE where both starch and sugar are packed. Conveyor bridge shown is the type that will be used throughout the entire Corpus Christi plant.



SUGAR HOUSE where part of the product is processed as sugar. It is going to look like this early in 1949. ▲ Here is how it looked early this summer. ➡

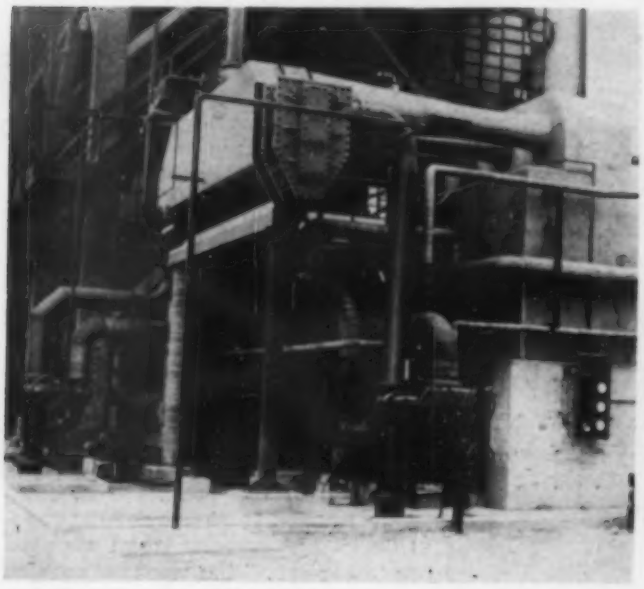


ination had to be eliminated. Many of the buildings have enclosed stair towers. These are provided for three principal reasons: (1) fire protection for personnel; (2) they afford a retreat for personnel and a windbreak during the few inclement days during the year; and (3) they afford a location for elevators and toilet facilities which are grouped in these towers.

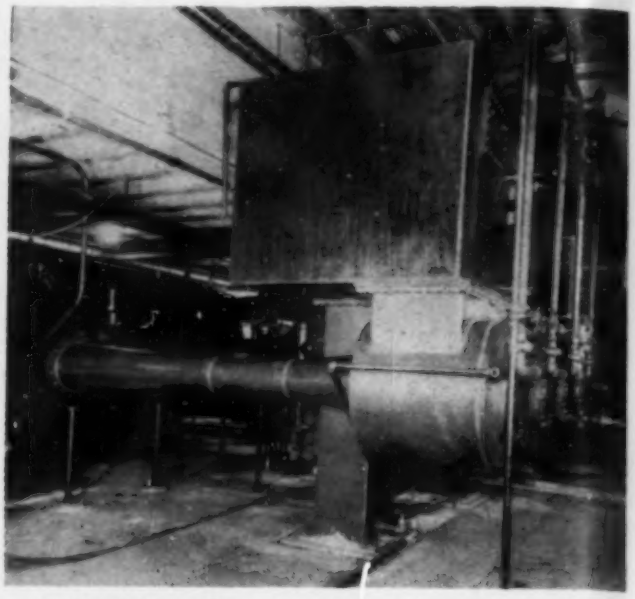
The physical layout of the plant was predicated principally on the location of three principal structures. These included a large two million bushel storage unit, the administration area and the power unit. The storage unit was located where it is suited for receiving grain by truck and train, with the possibility of a future marine leg to be utilized for ship unloading if the ship channel is completed and transportation by this method is economically feasible. Inasmuch as large quantities of low pressure steam are used in the process, the shortest possible runs to production units were of major consequence. It was therefore decided to locate the power plant in the center of the project, along with the machine shops which also serve the entire area. The third group, the administration department, consists of a time and pay office, locker rooms, cafeteria, offices and laboratory. Since there is a division of administration responsibilities inasmuch as the time and pay sections deal exclusively with personnel and the remainder of the administrative section deals with production, the two functions were separated. The time and pay section was placed at the entrance of the plant where it had easy access to the flow of personnel in and out of the area; the production administrative force, together with the control laboratory, is located near the center of the plant, overlooking Neuces Bay.

The remaining process layout follows in an orderly pattern from this point, with spacing considerations being given to fire protection and the possibility of future expansion.

APPLICATIONS—These four modern applications for steam jet refrigeration sugge[illegible]oad r[illegible]



BUTADIENE—This 425-ton steam jet water vapor refrigeration unit is one of five helping to make butadiene. Fig. 1



AIR-CONDITIONING—Two 600-ton inverted units shown here provide air conditioning in an auditorium. Fig. 2

Do You Know Enough About S

THEORY—Water vaporizes at high vacuum and in so doing cools the unvaporized portion.

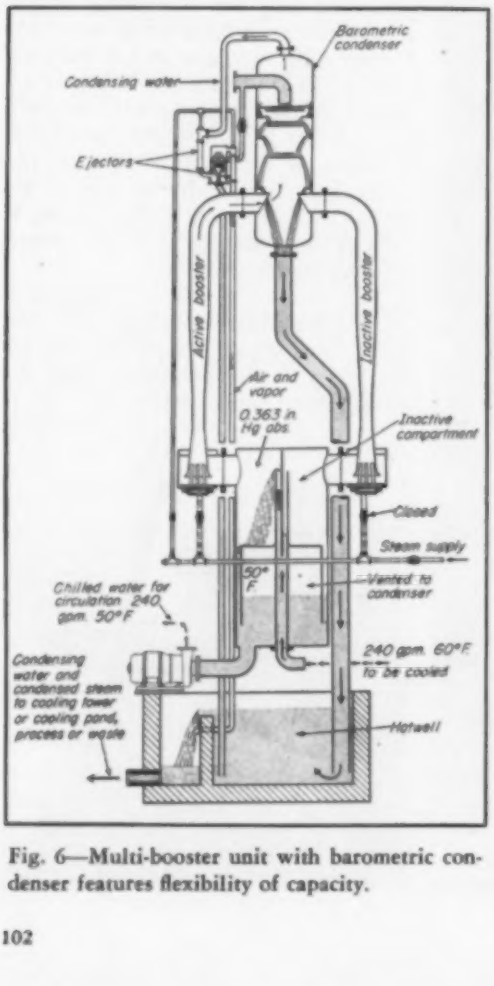


Fig. 6—Multi-booster unit with barometric condenser features flexibility of capacity.

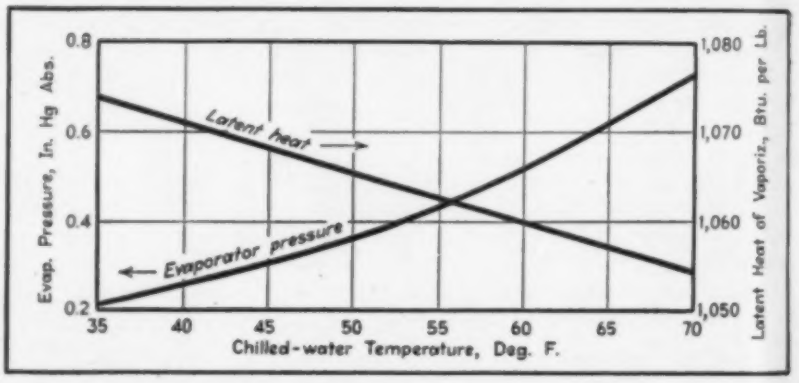


Fig. 5—Chart shows what chilled water temperatures result from any given evaporator pressure and how many Btu. each pound evaporated will remove.

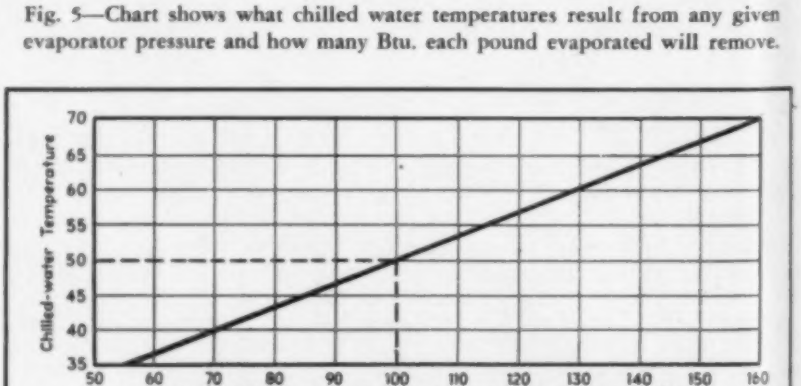
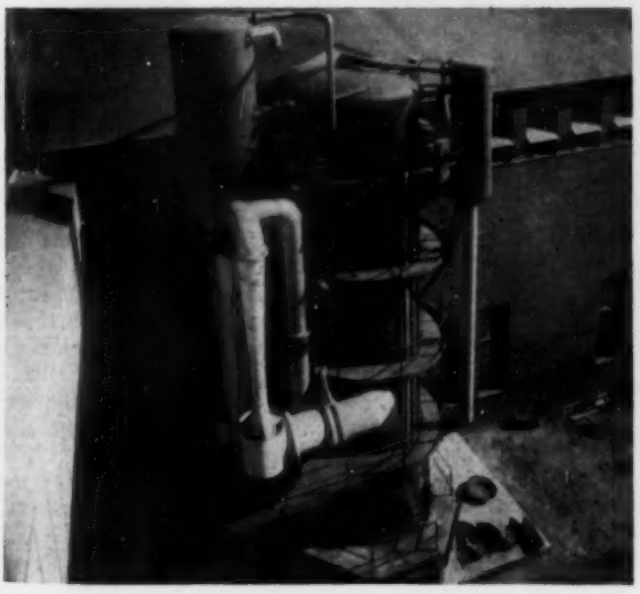


Fig. 7—Large overload capacity of steam jet refrigeration units is shown by this curve indicating variation in tonnage with water temperature.

...ad range of process industry use where temperatures above 32 deg. F. are needed.

CITY GAS—This multi-booster unit is used to cool city gas to condense water and tar ahead of service lines. Fig. 3



DISTILLERS MASH—Owing to extremely wide cooling range, this large unit employs five stages in series. Fig. 4

Steam Jet Refrigeration?

Howard R. Havemeyer
Engineer, Ingersoll-Rand Co., New York, N. Y.

STEAM JET water vapor refrigeration is a modern, simple and safe method of producing refrigeration at temperatures above the freezing point of water (32 deg. F.). It is now widely used and possesses marked advantages for applications somewhat above its minimum possible temperature, provided that sufficient steam and cooling water are available at reasonable cost. The method has been perfected and commercially proved over the past 15 years, but there are still a surprising number of engineers who are not yet fully aware of its availability, potentialities and wide application.

One reason for this general lack of knowledge, perhaps, is that engineering text books still treat it as a theoretical curiosity and have little to say regarding its merits. Perhaps another reason for the lack of published information on the practical aspects of the method comes from the fact that the refrigeration industry developed around the production of sub-freezing temperatures that require chemical refrigerants, and it is only comparatively recently that a demand for refrigeration at temperatures above 32 deg. F. has arisen. Now, however, comfort cooling, air conditioning and industrial process cooling have come into the picture and have made the water vapor refrigeration cycle commercially attractive.

Steam jet ejector manufacturers were quick to appreciate the possibilities of this new market and during the past 25 years of continuous research and development have succeeded in perfecting today's efficient refrigeration units.

Water Cools Itself

In this system water, the only refrigerant used, is introduced into an insulated chamber in which a vacuum is maintained so as to cause part of the water to evaporate. The latent heat for that part which evaporates is furnished by the remaining water, which is thereby cooled. The vacuum is maintained by a suitable combination of steam jet ejectors and condensers, the latter either of the barometric or the surface type.

Since each pound of water evaporated removes somewhat over 1,000 Btu. of latent heat, a corresponding number of Btu. of sensible heat will be removed from the remaining water which means that, for example, 100 lb. will be cooled approximately 10 deg. F. Since each "ton" of refrigeration produced by any sort of refrigeration system means the removal of 12,000 Btu. per hour, it is evident that the evaporation of slightly less than 12 lb. of water per hour is thus equivalent to one ton of refrigeration. The evaporator temperature that will be maintained, of course, depends upon the vacuum that is maintained, which in turn depends upon the work that is accomplished by the ejector-condenser system. To operate such a system the only utilities required are steam for the ejectors, cooling water for the condensers, and steam or electricity for the cold water and condenser water pumps.

System Characteristics

Although a steam jet refrigeration unit requires more cooling water than a system employing a chemical refrigerant, it has advantages of its own which will often dictate its use where temperatures of say 35 deg. F. or higher can be used. Assuming adequate quantity and reasonable cost for steam and cooling water, some of its advantageous characteristics may be listed as follows:

1. No moving parts except the

pumps—hence, low maintenance and supervisory costs, a low spare-parts inventory, a high degree of reliability, no noise or vibration.

2. Can easily be controlled automatically, requires practically no attention, and can adjust steam and water consumption to the load.

3. Since water is the refrigerant, there is neither refrigerant hazard nor cost. Pressures are low, much below atmospheric.

4. Low first cost, installation cost and operating cost. In fact, waste low-pressure steam can frequently be used and the warmed cooling water from the condenser can often be used for process.

5. Units are easy to start and to shut down.

6. Units respond easily to load variations. They have a high overload capacity with only a slight increase in cold water temperature which is desirable for quick starts as well as for overloads.

7. Units are exceptionally economical at higher chilled water temperatures, the economy increasing with the temperature.

8. Surface condensers can be used if condensate recovery is desired, or the more economical barometric condensers if that is unnecessary.

9. With either type of condenser the unit can be installed outdoors.

10. Arrangements are exceptionally flexible and units can be fitted into odd or small spaces.

11. The barometric type is self-supporting, low in weight and can be installed on a roof if desired.

12. Pumps can be turbine driven to eliminate any possible explosion hazard.

13. If used only in warmer seasons the steam required can often be secured cheaply from otherwise lightly loaded boilers, or may be purchased advantageously at off-season utility rates.

14. The same principle can be, and is, used extensively for the direct flash cooling of solutions, as in crystallizers and mash coolers, by evaporating a small part of the water of the solution. Hence, no heat transfer between solution and cooling medium is required.

Jet Refrigeration Uses

To those accustomed to thinking of refrigeration in terms of subfreezing temperatures, it might seem that there would be relatively little application for the steam jet system. The number and variety of applications actually is surprisingly large. A number of these are discussed below to illustrate the wide range of usage. In each case some of the principal reasons for choosing water vapor refrigeration are mentioned.

Rubber Rolls and Mixers—Several major rubber processors in the United States have installed steam jet refrigeration units to produce cold water at about 50 deg. F. for cooling rubber rolls and mixers. In this way they can assure quality and maintain production in spite of seasonal variations in local water temperature which frequently may reach 85 deg. F. in summer months. One manufacturer alone has installed three units each of 300 tons capacity in different plants, each cooling 1,030 gpm. from 57 to 50 deg. F. Low first cost and operating cost, a moderate chilled water temperature, and availability of steam and cooling water at reasonable cost where the factors determining the choice.

Process Liquids and Gases—Many process industries are using steam jet refrigeration units to produce cold water for circulating through tubular heat exchangers used to cool caustic solutions, lube oils, compressed gases, distillery mash and slop, and other products. In addition to the advantages of low costs and maintenance, the lack of explosion hazard has been a factor in the choice of this system in many of these cases.

Gas Absorption—When water is employed to absorb gas it is usually an advantage to be able to use cold water and so increase the absorption. Such cases are encountered frequently in both chemical plants and sulphite pulp mills. Trouble with local water is especially prevalent in the warm summer months. Several pulp mills are using jet refrigeration to produce 50-deg. water since it will absorb about 50 percent more SO_2 than 75 deg. water. One typical unit now being installed will cool 144 gpm. of water from 75 deg. to 50 deg. F., which is equivalent to 150 tons of refrigeration at 50 deg. F. The unit will have automatic controls to reduce steam consumption proportionately as refrigeration needs decrease.

Distillation—In many distillation operations in the process field adequate fractionation cannot be obtained with warm condenser water and as a consequence steam jet refrigeration units are being used increasingly for cooling the condenser water supply. Applications of this type fall in the pharmaceutical, chemical, petroleum, synthetic rubber and solvent extraction industries. Often the inherent safety of this method of refrigeration is important owing to the presence of solvent-containing or other potentially explosive atmospheres. The unit shown in Fig. 1, which is equipped with a surface condenser, is one of five duplicate 425-ton units installed in different synthetic rubber plants to supply chilled water for distillation condensers. Outdoor installation eliminates building investment, while the use of jet refrigeration assures minimum maintenance expense.

Air Conditioning—With adequate steam and water at reasonable cost the steam jet refrigeration method is well suited to comfort cooling and air conditioning because of the economical water temperature that can be used, and freedom from hazard. A new 50-ton unit for conditioning offices and laboratories has recently been purchased by an industrial concern to supplement an existing unit of the same type in use since 1940. In this particular case the plant boilers operate at minimum load during the summer due to the absence of heating load, and jet cooling becomes especially attractive. In other cases utility companies supplying steam will offer price concessions for a summer steam jet cooling load.

High Overload Capacity

A characteristic of jet refrigeration particularly suited to air conditioning is its large overload capacity at slightly higher chilled water temperatures. This means reduced cooling-down time, as well as ability to carry overloads readily. At the same time, however, units are readily controlled automatically to minimize steam consumption. Flexibility of equipment arrangement is often advantageous. The two units of Fig. 2, for example, are inverted to conform to very restricted headroom.

Fuel Gas Cooling—A type of application of interest to the gas industry is shown in Fig. 3. A number of gas companies have eliminated the problem of condensation of water and tar in their service lines and apparatus by use of steam jet refrigeration units. These provide chilled water to surface condensers in which objectionable impurities are removed ahead of the distribution system. Low internal pressures and the absence of moving parts, except pumps, are of advantage in minimizing any potential hazard.

Beverage Cooling—For many years the brewing and distilling industries have been handicapped by high summer water temperatures in the cooling of large quantities of wort and mash. Since these materials (like many solutions encountered in the chemical industry) contain considerable quantities of water, they can readily be flash cooled by direct evacuation in a flash

chamber. A considerable number of such units has been installed, employing steam jets just as in water cooling. One now in use in a large midwestern distillery (Fig. 4) utilizes a five-stage evaporator to conserve steam and water and each hour cools 270,000 lb. of mash at 145 deg. and 106,000 lb. of slop at 197 deg. to a final mixture temperature of 75 deg. F. (This plant will be described in detail in an early issue. —*Editor.*) Other products similarly cooled include sugar, starch and caustic solutions, and yeast. An important advantage is that no allowance for fouling of heat transfer surfaces is needed since the material is cooled directly without transfer surfaces.

Calender Rolls—A northeastern paper mill has recently ordered a steam jet refrigeration system for cooling hot calendar rolls with 40 deg. F. water in a closed circuit. The capacity of the unit is 28 tons of refrigeration and the installation operates at practically no cost since it uses 7 psig. waste steam, with the cooling water (now containing the heat from the steam) discharged from the surface condenser to process.

Other Applications—Steam jet refrigeration systems are being used to cool drinking water. They are being applied, too, for summer cooling of air- and hydrogen-cooled generators. Although relatively new in this application, they are beginning to go into marine use and have been applied for air conditioning on such vessels as the Queen Mary, Queen Elizabeth and the Empress of Britain, as well as warships and fruit ships. Some of the banana ships, in fact, are using steam jet refrigeration in lieu of other methods since bananas do not require as low a storage temperature as most other fruits. Here a temperature of 56-60 deg. F. is desired.

Many of the favorable factors already mentioned apply notably in shipboard use, particularly the lack of moving parts, freedom from noise and vibration, and flexibility of installation which makes it possible to use otherwise useless space. An important consideration is the fact that the cost of cooling water can be considered negligible.

In a very general way the applications mentioned show how the inherent characteristics of steam jet refrigeration are especially suited to a variety of requirements. However, it must be emphasized that a careful evaluation of the characteristics is necessary for each particular case in the light of local conditions applying to such factors as type of load and service, availability and cost of steam and water, and first cost of equipment.

Favorable characteristics of steam jet refrigeration systems have already been summarized but it will be well at this point to comment further on a number of them as well as to mention the possible limitations of the method. In the first place, normal rates for steam and water must prevail, adequate quantities must be available, and it must be recognized that more cooling water will be required than for other refrigeration methods. Granted these conditions, first cost will usually be low for units of 30 tons capacity or larger. The highest possible chilled water temperature consistent with the service should be used. This will result in considerable savings in both first and operating costs. Investment will be considerably lower with barometric condensers. Operating cost can often be reduced by use of cheap low pressure or extraction steam.

Advantages that usually deserve important consideration include low maintenance, light weight, freedom from noise and vibration, and the possibility of outdoor installation without building protection. Simplicity of control means minimum attendance and simplicity of control equipment, while inherent safety, high reserve capacity, and flexibility of installation are often weighty determining factors. Start-up and shut-down are particularly simple and attention is not needed during shut-down periods, provided the unit has previously been drained if danger of freezing exists.

How System Works

The water vapor refrigeration cycle is similar to the vapor compression cycle using a chemical refrigerant, except that the physical properties of water and water vapor make high pressures unnecessary. At the same time, the water evaporated to produce the refrigeration effect is normally not reused. The pressures involved in a refrigeration unit of this type are far below atmosphere.

It is not possible for water to remain a liquid if the pressure over it is reduced to less than its vapor pressure at the existing temperature, as given in Fig. 5. Thus, if water at some temperature higher than 50 deg. F. is introduced into a closed chamber in which the pressure is maintained at 0.363 in. Hg abs. (29.637 in. Hg vacuum referred to a 30-in. barometer) part of the water will flash into steam.

Since each pound of water evaporated absorbs heat from the remaining water equal to the latent heat of steam at the evaporator pressure (Fig. 5), the water which remains is cooled an equivalent amount.

Thus, in a commercial unit, if 240 gpm. of water at 60 deg. F. (120,000 lb. per hour) is introduced into an insulated evaporator or flash chamber in which the pressure is maintained at 0.363 in. Hg abs., part of the water will evaporate, cooling the remainder to 50 deg. F.

The quantity of water which will be evaporated is equivalent to the total heat removed, that is, 10 Btu. per lb. (10 deg. F. cooling) times 120,000 lb. per hour, divided by the latent heat of vaporization, or pounds per hour evaporated = $10 \times 120{,}000/1{,}065$ = approximately 1,130 lb. per hour.

This 1,130 lb. per hour (2.26 gpm.) of water evaporated is less than 1 percent of the water introduced to the evaporator and its loss is compensated for automatically by a liquid level control valve, which adds water to the evaporator from some external source.

Since 1 ton of refrigeration is equal to 12,000 Btu. per hour, the actual refrigeration tonnage produced in this example is equal to 100 tons at 50 deg. F. chilled water temperature.

In order to maintain the required low evaporator pressure, so that continuous cooling may take place, the vapor evaporated must be continuously and efficiently removed. This is accomplished by the use of a vapor booster ejector, which is the heart of this type of refrigeration unit. It removes the vapor evaporated in the flash chamber and compresses it to a higher pressure at which it is condensed in a booster condenser. With normal condensing water temperatures, the booster condenser pressure may be from 1¼ to 2½ in. Hg abs. The optimum condenser pressure depends on the relative cost or availability of steam and condensing water, and the temperature of the condensing water.

All of the vapor, plus the motive steam required for the booster ejector stage, is condensed in the booster condenser. Since the condenser operates under vacuum, some form of air removal equipment is needed to purge it of air. This usually consists of a small two-stage air ejector which requires only a relatively small fraction of the steam and water needed for the booster ejector and the booster condenser.

Design of Units

In Fig. 6 a simplified cross-section of a typical barometric type unit is shown, designed to cool 240 gpm. from 60 to 50 deg. F., equivalent to 100 tons of refrigeration. Barometric type condensers are used where low first cost is desired, condensate recovery is not important and where sufficient head room is available. They can also be used in

cases where condensing water is dirty and would foul surface condenser tubes. Since water is drained by gravity from the barometric condenser, which is under high vacuum, a 34-ft. barometric leg is required. This would make the over-all height, of the unit illustrated in Fig. 6, approximately 48 ft.

These units are usually installed out-of-doors and therefore this height is no objection. Since they require only a simple foundation, as illustrated in Fig. 3, low installation cost is assured.

Surface type condensers, on the other hand, are used where condensate recovery and/or low height are important. This type of unit is used where indoor installation is desired, as in Fig. 2. Indoor installation of this type, however, is not essential and many of these units are also installed out-of-doors as illustrated in Fig. 1.

One characteristic of a steam jet ejector is that the capacity at a given suction pressure is practically constant, and is not appreciably affected by changes in the quantity of motive steam used. The only appreciable effect of changing the quantity of motive steam used is to change the discharge pressure against which the booster can work. For this reason, it is not practical to attempt to regulate the refrigeration capacity of this type of unit by throttling the booster steam flow.

Regulation Methods

Where such regulation is desirable for economy at part load conditions, it is accomplished by operating the booster intermittently by the use of automatic controls, which may be set to maintain the chilled water temperature within plus or minus 1 deg. F. of the optimum operating temperature. This is accomplished by using a thermostat, which is immersed in the chilled water discharge line and actuates a relay supplying air to a pneumatically operated valve in the booster steam supply line.

An arrangement used with larger steam jet refrigeration units employs multiple booster ejectors which operate in parallel as illustrated in Fig. 6. This sketch shows a cross-section view of an Ingersoll-Rand steam jet refrigeration unit of the barometric type, with a patented weir type evaporator. By taking one booster out of operation (either manually or automatically) simply by closing the steam valve, the refrigeration capacity and the booster steam consumption are reduced a proportional amount. Where manual regulation is used to suit refrigeration capacity to seasonal changes, corresponding savings may also be made in condensing water requirements.

When cooler condensing water becomes available as a result of seasonal changes, it is possible to throttle the booster steam quantity, since the condenser pressure to which the booster must discharge is reduced as a result of the cooler condensing water. This yields a proportional reduction in operating cost. It is impossible to generalize regarding the magnitude of savings resulting from taking advantage of cooler condensing water in this manner, since too many variables are involved. For the sake of illustration, however, it is estimated that the booster steam consumption under normal conditions can be reduced in this way about 40 percent annually.

Steam jet refrigeration units inherently have a large overload capacity resulting from the shape of the characteristic capacity curve of the booster ejectors. For example, a unit which will produce 100 tons of refrigeration at 50 deg. F. chilled water temperature will be capable of producing approximately 115 tons with an increase of only 5 deg. F. in the chilled water temperature. Fig. 7 shows the variation in booster capacity plotted against chilled water temperature.

This reserve capacity is a valuable asset where variations in refrigeration requirements may result in increase in refrigeration loads. It is also valuable since it reduces the time required to cool down a refrigeration system when starting up.

When the water to be cooled is cooled over large temperature ranges, two-stage evaporators may be furnished at only slight increase in first cost. Considerable savings can thus be made in steam and condensing water requirements when the cooling range is 20 deg. F. or more. In the two-stage evaporator, part of the evaporation takes place in the first stage at a temperature and pressure considerably higher than the final chilled water temperature and, therefore, less steam and condensing water are required. After being partially cooled in the first stage, the water flows to the second stage where it is further cooled to the required final chilled water temperature. By using a two-stage evaporator instead of a single-stage for cooling 20 deg. F., steam and condensing water savings of approximately 20 percent or more can be realized under normal conditions.

The pumps required for a steam jet refrigeration unit include one water pump for removing the chilled water from the evaporator which is under high vacuum, one circulating water pump for supplying condensing water to the booster condenser (when water is not available at sufficient pressure), and one condensate pump which, however, is required only with surface type condenser units.

These pumps are usually of the conventional centrifugal type, with the chilled water and condensate pumps normally selected to operate with a maximum net positive suction head of only 4 to 5 ft. Special consideration should be given to the proper selection of these pumps in order to assure suitable operating characteristics.

Selection of a Unit

It is not the purpose of this article to attempt to give specific data on the performance of these units as this would be meaningless on account of the many variables involved, such as steam pressure, condensing water temperature, chilled water temperature, relative cost and availability of steam and water, etc.

In order properly to evaluate the use of a water vapor steam jet refrigeration system for any particular application, it is necessary to give due consideration to all local factors and thus to secure the best possible installation. Manufacturers of this type of equipment should be consulted for information of this nature.

To assure the most economical steam jet refrigeration plant, the highest possible chilled water temperature compatible with utilization requirements should be used. In determining this temperature, no allowance need be made for deterioration of capacity as is necessary in mechanical refrigeration plants using tubular water coolers. In the latter, fouling or scaling of the tubes will, in time, reduce the refrigeration effect, thus eventually resulting in higher chilled water temperatures. With jet units, however, the water cooling is accomplished by direct evaporation and there is no such loss in efficiency.

To summarize, an economical installation is secured by using the highest possible chilled water temperature and the optimum steam-to-water ratio. To estimate such a system the estimator must be supplied with data on the desired refrigeration capacity, feed water temperatures, chilled water delivery temperature and pressure, as well as information on the minimum operating steam pressure, and maximum quantity available, the maximum condensing water supply temperature, and information on its source and maximum rate of supply. He must know whether a barometric or surface condenser is required and, if the latter, what condensate delivery pressure will be needed.

These Short-Cuts Will Speed Your Design and Estimation of Tanks

Six charts presented in this article permit the design and cost estimation of most tanks up to about 1,000 gal. capacity to be made in a fraction of the usual time.

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PROCESS EQUIPMENT COSTS

A LARGE part of the chemical engineer's work is concerned with pumps, piping and tanks. Of these three, by far the most time-consuming is the selection and specification of tanks. We have found that the charts presented with this article have been of material assistance in this time-consuming operation.

In the design of a tank we usually start with the capacity in gallons. Let us first consider a storage tank in plain steel with a tight cover but designed for a nominal pressure of, say, 10 psi. We may choose, for example, a 400-gal. capacity tank similar to Fig. 1.

Referring to chart of Fig. 3 we find that we can use a diameter of 48 in. and a height of 52 in. It is, of course, desirable to select the outside diameter in multiples of 6 in. if we are going to use a dished-head tank, as this conforms to standard dished heads. We could also use an outside diameter of 4 ft. 6 in. and a height of 40 in. with just about the same weight of material.

Three charts are provided for determining the thickness required for the shell and heads of the vessel. Fig. 4, for the shell thickness, is based on the ASME Code for unfired pressure vessels, section U-20, which gives the thickness as $t = PR/(SE - 0.6P)$. Fig. 5, for the thickness of flat bolted heads, is based on ASME Code U-39 which gives the thickness as $t = 2R\sqrt{CP/S}$. For a welded head the thickness so obtained is multiplied by a factor of 1.242. Fig. 6, for the thickness of dished heads with pressure on the concave side, is based on ASME Code U-36 which gives the thickness at $t = 5\ PL/6SE$. For pressure on the convex side the thickness so obtained is multiplied by 1.67.

In these equations t is the thickness, inches; P is the allowable working pressure psi.; R is the inside radius of the vessel, inches; S is the allowable working stress, psi.; C is a factor for the bolted heads, 0.162; and L is the radius of a dished head. The joint efficiency E is taken as 0.9 for the shell thickness equation, and as 1.0 for the dished head equation. The three charts, Figs. 4, 5 and 6, are all drawn for plain steel, with an allowable unit stress S of 11,000 psi. If the charts are to be used for stainless steel, Monel or nickel, for which S is taken as 15,000, the thickness obtained from the chart may be multiplied by 0.734 in the case of Figs. 4 and 6, or by 0.856 in the case of Fig. 5.

To determine the thickness of the shell for 10 psi. pressure we refer to Fig. 4. Reading up from 48 in. to the line marked $P = 10$ psi., we

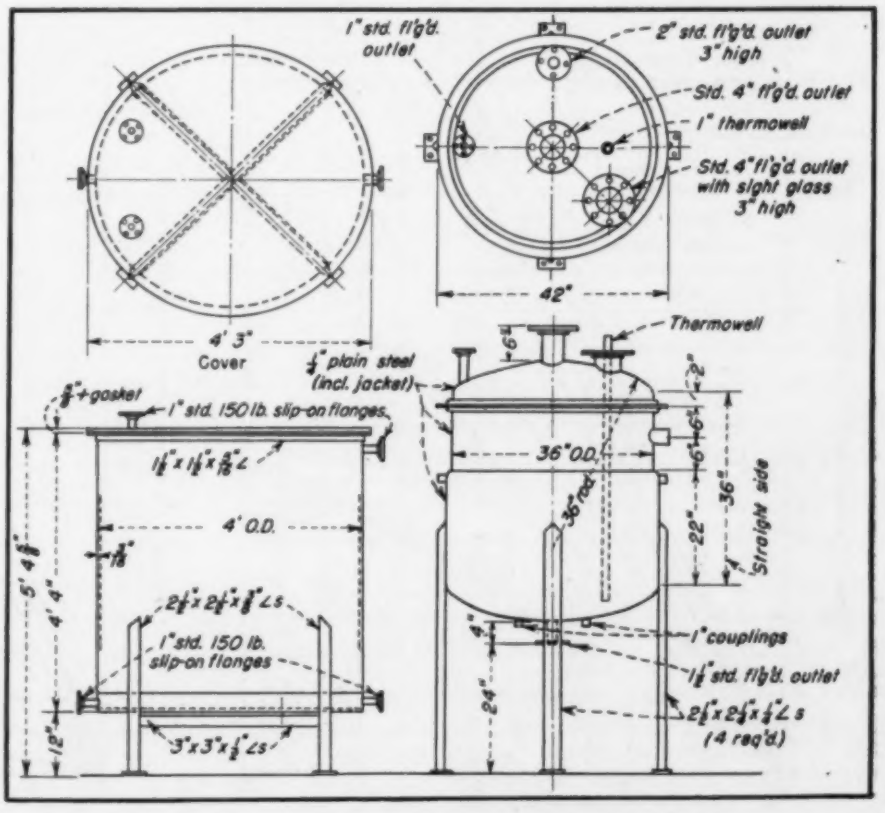

Fig. 1—Typical 400-gal. flat-head tank.

Fig. 2—Typical small dished-head tank.

With these four charts tank diameter and height, as well as shell and head thickness, can quickly be obtained.

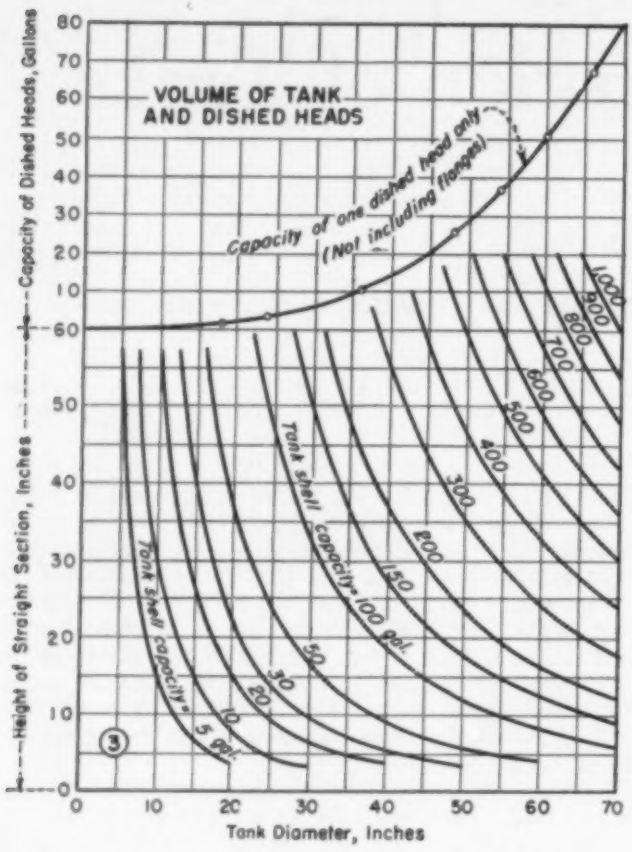
VOLUME OF TANK AND DISHED HEADS
Capacity of one dished head only (Not including flanges)
Tank shell capacity, 100 gal.
Tank shell capacity, 5 gal.
Height of Straight Section, Inches
Capacity of Dished Heads, Gallons
Tank Diameter, Inches
3

Fig. 3—Curves for tank shell and dished head volume.

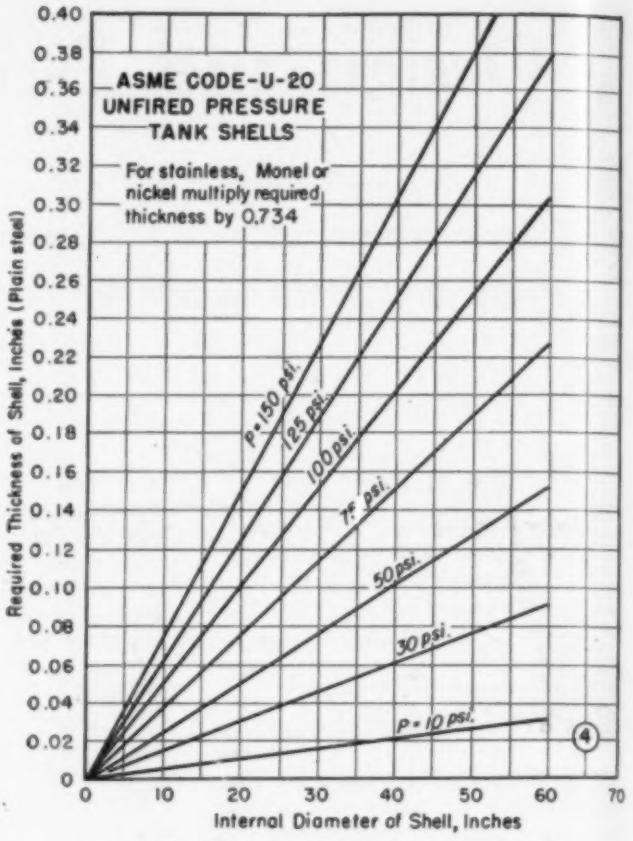

Fig. 4—Thickness for shell of unfired steel tanks.

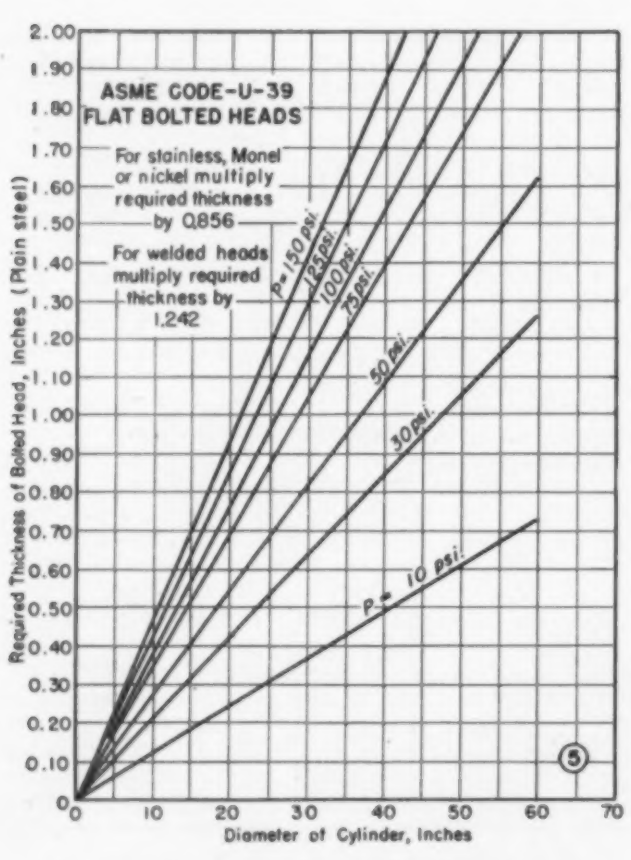

Fig. 5—Required thickness for flat bolted steel heads.

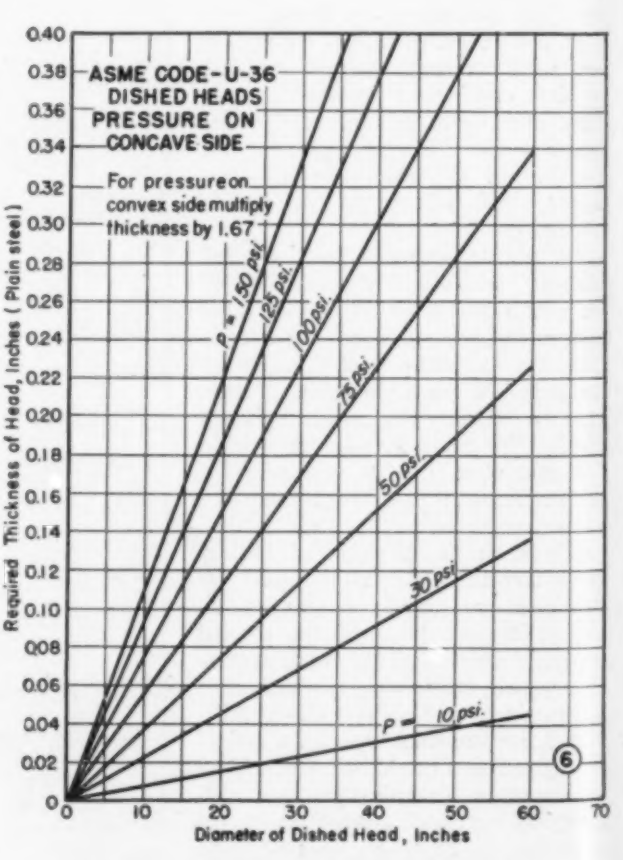

Fig. 6—Required thickness for dished steel heads.

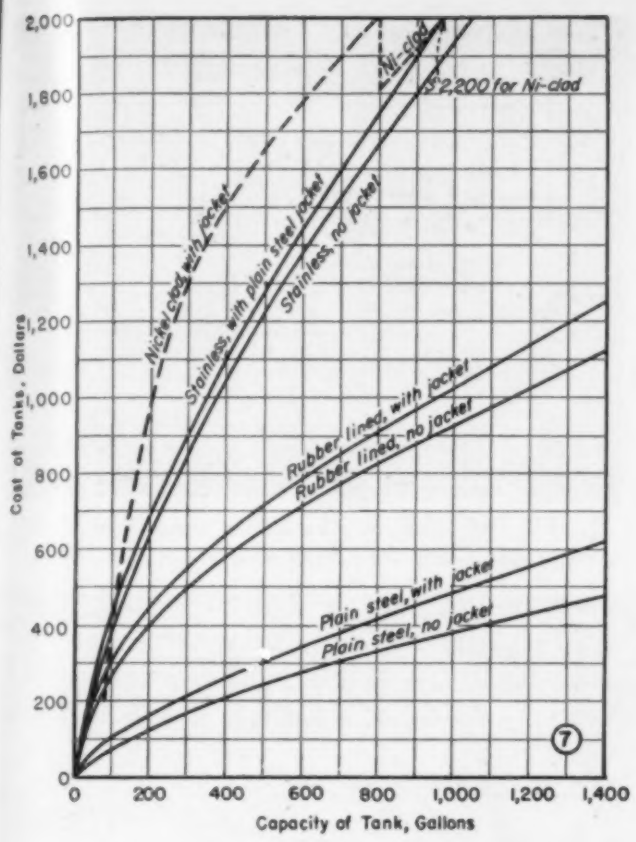

Fig. 7—Approximate cost of flat-head metal tanks.

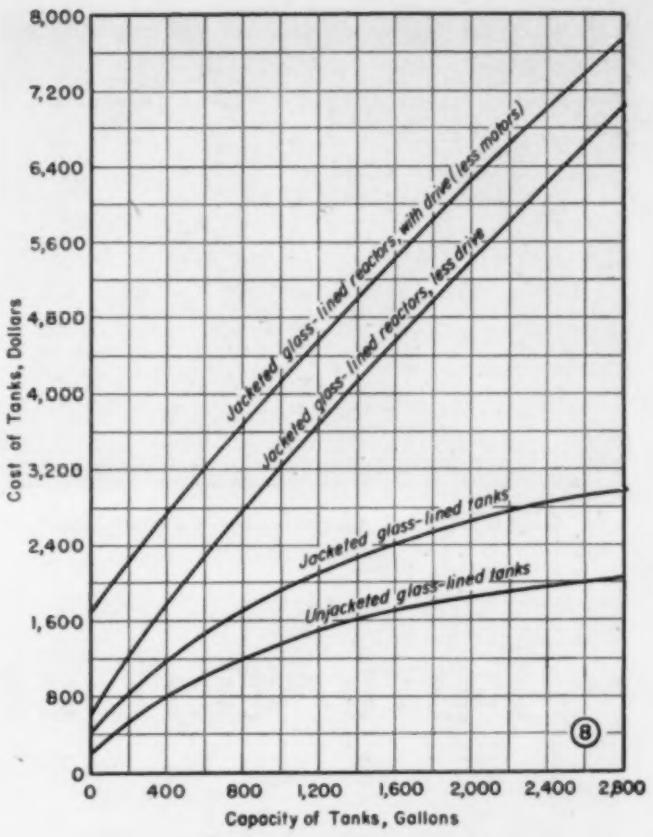

Fig. 8—Approximate cost of flat-head glass-lined tanks.

find that for plain steel we would require a thickness of 0.024 in. However, for the sake of stiffness and a corrosion allowance, we would not use less than 3/16 in.

Now, for the thickness of the bolted head, we use Fig. 5. Here we notice a real difference in thickness required by the ASME Code. Reading up from the 48 in. diameter to the 10 psi. line we find that we require a thickness of 0.59 in. and should use 0.625 in. or $\frac{5}{8}$ in. The bottom is shown as a flanged (but not dished) head which would take the same thickness. If we were to use a flat plate welded on the bottom we would multiply the indicated thickness 0.59 in. by the factor 1.242, which results in a thickness of 0.734 in. or $\frac{3}{4}$ in. plate. It is evident from these figures that if we require much pressure in the tank, we should go to a dished head. Referring to Fig. 6 we discover that a dished head of 48 in. O. D., under 10 psi. pressure on the concave side, requires only 0.036 in. thickness, which is quite different from the 0.734 in. required for a flat welded plate.

Having proceeded thus far, we want to know the cost of the tank. If we refer to Fig. 7 we can follow up from 400-gal. capacity to the curve for plain steel tanks. The cost of an unjacketed tank should be about $200. This curve is based on a tank with diameter and height nearly equal, and $\frac{1}{4}$ in. wall thickness. The tank we have just designed varies from this but the cost will be about the same. If we add a jacket to the tank, the total cost will be $260. If we decide on a rubber-lined jacketed tank, the cost will be about $635 and if we choose a stainless-steel jacketed tank the cost will rise to $1,100.

This comparison is very convenient where there is a corrosion or contamination problem. If we wish to know the cost in nickel-clad steel we refer to the dashed curve on Fig. 7. The cost of the jacketed tank will be about $1,500. Sometimes, in small sizes, we can secure a pure nickel tank for the same or nearly the same price. Fig. 8 gives the cost of a 400-gal. glass-lined jacketed tank as $1,160.

Another type of tank that is also popular in the chemical industry is shown in Fig. 2. This is often used as a reactor by providing a stirrer. It is well suited for moderate pressures in both tank and jacket. In considering pressure, however, we should be careful to distinguish between pressures on the concave and on the convex sides of the dished heads. For instances, if we had a moderate vacuum in the tank, we would have a pressure of the atmosphere of, say, 14 psi. on the convex side of the top head. This would require a thickness for the 36 in. diameter tank of 0.038 in. multiplied by the factor 1.67 for pressure on the convex side, or a total of 0.063 in. In figuring the bottom dished head we should add 14 psi. to the jacket pressure on the convex side.

The quoted price of the tank shown in Fig. 2 is $259, which compares with $135 for a Fig. 1 tank of the same capacity (about 150 gal.). We should observe here that the curve at the top of Fig. 3 gives the capacity of one dished head in gallons. Thus our 3-ft. tank would have 10 gal. capacity in each head or 170 gal. for the tank when completely filled. We can usually consider this added volume as freeboard, however.

For the dished head tank with $\frac{1}{4}$ in. thick heads, the cost factor is $259/135 = 1.92$, so a safe factor in estimating the cost of tanks of this type would be twice the costs shown on the curves of Fig. 7.

The prices given are for those prevailing as Niagara Falls. For other localities some known price for a tank should be compared to the curves shown and a factor established which can then be used for all other sizes.

1. DIGESTION of tungsten ore with hot potassium hydroxide to form potassium tungstate solution.

2. FILTRATION of effluent from tungsten digestor to remove solids from the K_2WO_3 solution.

Tungsten and Tantalum

TUNGSTEN PROCESS SHOWN ABOVE; TANTALUM PICTURED FLOWSHEET ON PAGE 152.

For the first time Fansteel Metallurgical Corp. has opened the doors of its war-built North Chicago plant. Surprisingly, production hangs not on metallurgical methods, but on chemical engineering (note unit operations shown).

James A. Lee
Managing Editor, *Chemical Engineering*

THIRTY-FIVE years ago the predecessor of the Fansteel Metallurgical Corp. at North Chicago had begun to manufacture tungsten. After mastering the powder metallurgy techniques for tungsten, it was a relatively simple matter to make molybdenum which was beginning to come into use by 1915. Tantalum was first produced commercially by Fansteel in 1922. Columbium followed. Production of these metals and their compounds proceeded at a pace sufficient for industrial needs. In 1940 and 1941 as the war clouds gathered, the need for greater quantities of these metals became apparent. Later the need, especially tantalum, became acute. Increased quantities of the metals could not be produced merely by multiplying existing equipment. It became necessary to design new and larger equipment, revise processes with a view toward mechanization and instrumentation, and in general plan toward larger units and batches.

Four months before Pearl Harbor blueprints for a $5 million tantalum plant were laid before the authorities in Washington. They contemplated skilled men being called into the armed forces and replaced by women operators. They contemplated special equipment of a size and capacity much larger than anything of its kind ever made before.

Approval was obtained and in January 1942 the Defense Plant Corp. authorized the construction of the plant to be operated under lease by Tantalum Defense Corp., Fansteel's wholly-owned subsidiary. The first shipment was made in September of that year. The following year, the need for more tungsten and molybdenum became apparent, and three additional buildings with necessary equipment were authorized and added to the Tantalum Defense plant. They were in production in March 1944. A year ago Tantalum Defense Corp. purchased the plants under a dormant estate contract under the terms of which productive capacity is to be maintained for a period of several years.

In 1944, Fansteel produced 12 times as much tantalum as in 1940, five times as much tungsten, six times as much molybdenum. The major part of the pure metals went into the manufacture of electronic tubes for communications and radar, although a large amount of tantalum was used in the fabrication of chemical plant equipment. To the very large number of applications for the metals during the war years many others are constantly being added.

The refractory metal industry of the early days of Fansteel centered largely around the late Clarence W. Balke, who became its director of research in 1916. The basic tantalum process was developed by Dr. Balke. The present-day process is an improvement of his basic process. The equipment in the new plants was largely planned and designed by Fansteel's chemical engineers, Dr. Rae Winchester and Donald F. Taylor.

3. CRYSTALLIZATION to purify tungstate. Photo shows vacuum pan filter and bottom of crystallizing tank.

4. PRECIPITATION of tungstic acid by reaction of hot hydrochloric acid on purified potassium tungstate.

5. REDUCTION of tungstic acid to tungsten metal powder through reaction with pure dry hydrogen. Measured amounts of the acid are placed in nickel alloy trays or "boats," then passed through gas-filled tubes projecting from furnace.

Briefly the process for the recovery of tantalum consists of fusing the tantalite ore with hot caustic, impurities are removed by a series of chemical treatments, finally resulting in a mixed solution of tantalum and columbium salts. A carefully controlled operation crystallizes potassium tantalum fluoride, K_2TaF_7, leaving potassium columbium oxy-fluoride in solution for subsequent recovery. Reduction to tantalum metal powder is accomplished by electrolysis of the fused salt.

The principal raw material for the production of metallic tantalum is tantalite ore. It is found in many countries. The leading sources are Brazil, Belgium Congo and Australia. There have been some medium grade ores found in this country in the Black Hills of South Dakota. Always associated with columbium, the ore contains iron and manganese tantalates and columbates.

A concentrate arrives at the plant in cloth bags. It is reduced in size, first in a jaw crusher and then in a Raymond hammer mill. The 200 mesh powder is put into oil-fired fusion pots with caustic soda. The crude sodium tantalate and sodium columbate is given a series of leachings with water. Tantalum and columbium bearing salts form a mud. All liquid material is washed out with hot water in an agitated steel tank. It is pumped to waste.

In a rubber-lined, agitated tank the brown mud is digested with hot hydrochloric acid. Acid-soluble impurities consisting of iron, manganese etc., are removed by decantation using a rubber hose as a siphon. In both this tank and in the one used in the preceding operation line steam serves to increase the agitation and to heat the materials.

At this point tantalum and columbium are in the solid state and mixed together. The mud, now white, is composed of tantalic and columbic acids. They are dissolved in hydrofluoric acid in a rubber-lined steel tank. Here the required amount of potassium carbonate is added to form the double salt of K_2TaF_7 and $K_2CbOF_5H_2O$. This salt is in solution. The hot solution is filtered in a wood plate and frame press, equipped with paper and cloth, to remove impurities. The mixed hot solution flows by gravity into hard rubber-lined crystallizing tanks. On cooling the potassium tantalum fluoride, which is very insoluble at room temperature, crystallizes, leaving the soluble potassium columbium oxyfluoride in solution. The latter is siphoned off and pumped into a rubber-lined tank. Lead coil heaters are used for indirect heating. The solution is evaporated somewhat and the columbium residue pumped to the recovery system.

The K_2TaF_7 crystals are filtered in a circular rubber-lined steel tank in which the filtering medium is canvas supported by a heavy laminated canvas impregnated with phenolic resin.

Crystals are put in wooden frames

with Masonite bottoms and dried in an air heated oven. The fluoride is reduced to metal powder by electrolysis of the fused salt in an iron pot. The powdered metal in the form of a cake is crushed and pulverized in a Raymond mill. This crude tantalum metal is separated from the fluoride salt by tabling on a Deister table. Pulverized metal is more easily washed free of residues with water. Drying is done in chemical stoneware bowls over steam coils. This powdered metallic tantalum is 99.9 percent pure.

Tungsten Production

In brief, the process used by Fansteel for recovery of tungsten starts with high grade concentrates of wolframite (iron and manganese tungstates). The ore is pulverized and digested with hot caustic. Repeated crystallizations purify the alkali tungstate, and tungstic acid, H_2WO_4, is precipitated with hydrochloric acid. The tungstic acid, a bright yellow powder, is washed, filtered, dried and pulverized. It is then reduced in hydrogen to metal powder.

Tungsten is derived from the ore wolframite. It is in the form of a tungstate of iron and manganese. The principal sources of the ore are Argentina, Bolivia, China, Burma and Australia. The premium grade concentrate used by Fansteel contains 70 to 73 percent WO_3.

It is crushed to 200 mesh in Raymond mills and taken to the top floor of the chemical building on an elevator. Here the crushed ore is put into agitated steel vessels. Caustic potash (45 percent) is metered as it is pumped from storage into the tank. After several hours of digestion the tungstate goes into solution as potassium tungstate, K_2WO_4. Iron and manganese are in the form of hydroxides. The contents of the tank are pumped to a plate and frame filter press. Solids are scraped off and put into buggies. The laboratory analyzes these solids for presence of tungstate. If none remains in the solids, they go to waste. Solids from which the tungstate have not been thoroughly removed are returned to the digester.

The tungstate solution from the filter press is pumped to a tank where there is additional separation of iron and manganese. It is done by addition of hot water. This material is given a second filtration in a plate and frame press. The tungstate solution is pumped to crystallizing tanks equipped with steam jackets and sweep-type agitators which remove crystals from the side of the vessel. The liquid material is pumped to a second crystallizer. The first salt is recrystallized. The final mother liquors are converted into tungstic acid and pumped back to the first digester which contains the ore. There is a total of three crystallizations.

Pure potassium tungstate is dissolved in water and filtered through canvas in a steel plate and frame filter press. The filtered solution goes to a storage tank. This tank serves as a feed tank for the four precipitators. These are rubberlined steel tanks which produce 1,500 lb. of tungstic acid per batch. The agitator is rubber covered. Heating is done by means of live steam which is introduced through a tantalum steam jet. The reaction is a conversion of potassium tungstate to tungstic acid, H_2WO_4, by precipitation with hydrochloric acid. Careful control of the introduction of the spray of tungstate solution into the acid solution is necessary so as to govern size of tungstic acid crystals.

The crystals are washed by decantation using a rubber hose siphon. They are further washed in a wooden plate and frame filter press. After washing, the tungstic acid is scraped from the press with a tantalum scraper and put onto glass trays. These are put into hot air drying ovens.

Dried tungstic acid crystals are pulverized in a screen mill and put into a Paterson blender. The acid is then reduced by hydrogen previously purified and dried in a Lectro system.

A measured volume of acid is put into a Nichrome boat which slowly passes through a gas fired reduction furnace. The heated section of the furnace tube is Inconel and the cool section is brass. Particle size of the metallic tungsten is controlled by temperature, rate of flow of hydrogen, and the time the metal is in furnace. The particle size desired depends upon the end use of the metal.. The size varies from 0.5 to 5 microns. When it is considered that powder may be obtained varying from extremely fine dust-like material with particle size below 0.5 micron to grains as coarse as sand, the importance of close control over the reducing conditions to produce a powder within these limits of particle size and distribution becomes apparent.

Reduction of molybdenum from purchased molybdic anhydride is essentially the same as the reduction of tungstic acid.

Unusual precautions have been taken throughout the plant to avoid the presence of fumes and dust in the atmosphere. Wood floors were laid so that there would be space between plank decking. This eliminates the possibility of fume pockets. Every processing tank in the plant is covered and equipped with a duct for fume removal. All fumes are absorbed so that outlets from the duct system are as free of fumes as the inlets. So that corrosive liquids will not be opened to the atmosphere, they are introduced into processing vessels through suitable piping. The quantities are measured by metering or by weighing in completely sealed weighing devices. It is a truly remarkable accomplishment in fume control. The day the plant was visited not a trace of odor was noticeable. The entire system including fans but excepting ducts over alkali tanks, which are black iron, is rubber-lined steel.

All waste alkali and acid solutions are discharged into a stoneware-lined holding tank. Fortunately, under normal operating conditions they neutralize one another so that the liquid discharge into the stream is almost neutral at all times.

Materials of Construction

All of the alkali system in the plant is piped and pumped with plain iron and steel. The slurry from decomposition of tungsten ore is pumped by Moyno pump. It is giving satisfactory service for this difficult operation. Hydrofluoric acid is pumped with a Monel centrifugal pump. It is handled in lead pipe. For handling hydrochloric acid rubber hose and pipe is used. If there is pressure, rubber-lined steel pipe is used. For one reason or another no material has been satisfactory for hydrochloric acid pumps.

The absence of physical handling of materials by operators is very noticeable. It is almost entirely a closed system. As a result so few operators are required that the plant does not have the appearance of being in operation.

The powdered tantalum, tungsten and molybdenum metals are compacted under many tons pressure into bars or ingots of suitable size and shape. These bars are of a fragile chalk-like consistency. Strength is given them by sintering. It consists of passing a heavy electric current through the bars. This has the effect of causing powdered particles to weld together into a sound metallic body.

Tungsten and molybdenum are sintered in a hydrogen atmosphere. Tantalum and columbium are sintered in a high vacuum. After sintering the metals are rolled, swaged, forged and drawn by conventional methods.

Tungsten and molybdenum are hot worked in protective atmospheres, tantalum and columbium are cold worked.

Thermofor Pyrolytic Cracking

Moving pebbles transfer heat to hydrocarbon feed in process that yields ethylene and certain aromatics.

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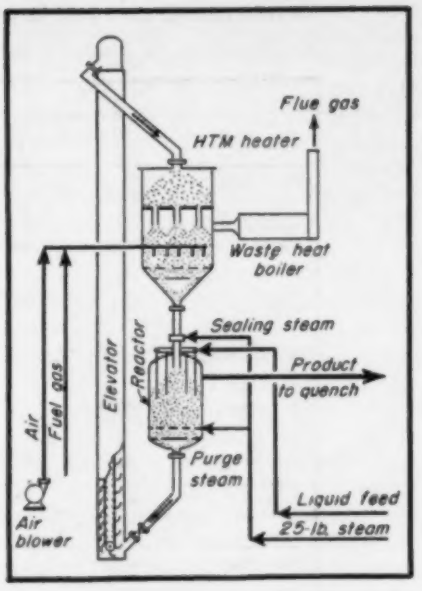

DEMAND of the booming chemical industry for ethylene and certain aromatics has been unprecedented since war's end. These chemicals go into plastics, synthetic rubbers, insecticides and other organics. Now Socony-Vacuum Oil Co., Inc., has developed a new process, called Thermofor Pyrolytic Cracking, that produces ethylene and aromatics by high-temperature, low-pressure cracking. Ethane or liquid charge stocks can be cracked.

In Thermofor Pyrolytic Cracking, or TPC, the hydrocarbon feed is contacted continuously with a moving bed of solids. Two main elements comprise the TPC system: a reactor and a heater. A bucket elevator lifts pebbles to the top of the unit where they are discharged into the heater. The heater preheats the pebbles to the required temperature by direct combustion of fuel gas in the pebble bed. Any coke deposited on the pebbles in the cracking step is burned off in this stage. Hot pebbles flow by gravity from the heater into the reactor. There the heat stored in the pebbles is used to preheat and to crack the hydrocarbon feed. Cooled pebbles from the reactor flow through a throttling valve and into the elevator which returns them to the top of the unit for re-use. A specially designed baffle system prevents the channeling of pebble flow in both reactor and heater.

Flow of hydrocarbons relative to pebbles through the reactor is countercurrent. The charge stock is either partially heated outside the reactor or introduced cold directly into the lower section of the reactor, where residual heat in the pebbles preheats or vaporizes the feed. Heat transfer rates as high as 15,000 Btu./hr./deg. F./cu. ft. of pebbles are obtained in this reactor. Thus rapid preheating of charge stock to high temperatures minimizes undesirable cracking at low temperatures. Cracking temperature is controlled by the temperature of the pebbles entering the reactor and by the ratio of pebble circulation rate to hydrocarbon charge rate. The hydrocarbon contact time is controlled by the vapor rate through the reactor and the bed depth. Cracked vapors leaving the reactor are quenched immediately to prevent decomposition or polymerization of the ethylene.

The TPC process can be designed to crack either gaseous or liquid feedstocks. Crude oils or reduced crudes can be handled just as easily as distillate stocks since any carbon formed on the pebbles during cracking is continuously removed from the reactor. Deposition of carbon in this manner lowers external fuel requirements in the heating stage.

Cracking studies have been made in a one-barrel-a-day TPC pilot unit capable of operating at temperatures up to 1,800 deg. F. Charge stocks ranging from ethane to reduced crudes have been evaluated for ethylene and aromatics production.

Once-through cracking of ethane with a pebble temperature of 1,525 deg. F. and a contact time of 2.3 sec. gives an ethylene yield of 49.2 percent. Recycling the unconverted ethane gives an ultimate yield of 60.1 percent at a recycle ratio of 0.22 parts recycle to 1.00 part fresh feed. Once-through cracking of propane with a pebble temperature of 1,510 deg. F. and a contact time of 1.2 sec. gives an ethylene yield of 37.5 percent by weight. From a mixture comprising by weight 40.8 percent ethane, 40.0 percent propane and 16.0 percent propylene at a pebble temperature of 1,500 deg. F., a contact time of 1.7 sec. and a recycle ratio of 1.00 part recycle to 1.00 part fresh feed, an ultimate ethylene yield of 62.0 percent by weight is obtained. For liquid charge stocks, ethylene yields range from 28 percent by weight of charge from the most paraffinic stock to 11.7 percent by weight from the most naphthenic stock.

In the case of both gaseous and liquid feedstocks, ethylene yields can be increased to some extent by raising the pebble temperature and decreasing the contact time. When liquid charge stocks are being cracked, the yields of other olefins, such as propylene, butylenes and butadiene, can be increased by decreasing the cracking temperature or contact time. Adjusting the operating conditions to increase the yields of these higher molecular weight olefins, however, generally results in a loss in ethylene yield.

Cracking of liquid stocks to produce ethylene gives a fraction boiling between 150 and 500 deg. F. that contains 40 to 75 percent by weight of aromatics. And concentration of aromatics in this liquid fraction can be increased to 90-95 percent by increasing the contact time of the cracking reaction. An appreciable yield of material boiling above 500 deg. F. is also produced from TPC cracking of liquid feedstocks.

The TPC process can be licensed from Socony-Vacuum through such contractors as Vulcan Copper & Supply Co. and Rust Engineering Co. Companies are now actively considering installation of TPC facilities to manufacture ethylene and aromatics. One project calls for cracking of 2,400 bbl. a day of East Texas crude to produce 50,000,000 lb. a year of ethylene.

Advantages of Thermofor Pyrolytic Cracking, then, are: (1) wide flexibility in charge stock; (2) efficient transfer of heat from the primary source to the hydrocarbon being cracked; (3) rapid heating of the hydrocarbon charge to high cracking temperatures; (4) continuous elimination of any coke formed in the reactor during cracking; and (5) ability to introduce charge stock into the reactor without preheat.

What materials are used? By what criteria are they judged? How well does each material

As determined in a special survey of leading jet pump manufacturers. For data on another variable, corrosion resistance, s

	Resistance to Heat, Deg. F.	Resistance to Thermal Shock	Resistance to Erosion	Machinability to Close Tolerances	Maintenance of Te in Replacement
Hard rubber	Poor (2) 230° (1)	Fair (1) Good (2)	Poor (1) Good within temperature limit (1)	Fair to Good (to 0.005) (1) Good (1)	Fair (1) Good (1)
Haveg	265° (2)	Good (2) Excellent (1)	Good (1) Fair (1)	Poor (1) Fair (1)	Poor (1) Fair (1) Good (1)
Karbate	338° (2) 350° (1) 365° (1) 400° (1)	Good (1) Excellent (4)	Good (4) Excellent for nozzles (1) Excellent for diffusers (1)	Good (1) Excellent (3) Excellent to 0.001–0.002 (1)	Good (1) Excellent (3) Same as original (1)
Porcelain	250° (1) 331° (1) Fair to Good (1)	Fair-Good (1) Good (2) Excellent (1)	Poor (1) Poor for nozzles (1) Good (1) Excellent for diffusers (1) Good for suction chambers and diffusers (1)	Not machinable (1) Nil (1)	Poor (1) Fair (2)
Pyrex	316° (1)	Poor, steam must be limited to 70psig.(1) Good(1) Excellent(1)	Poor for nozzles (1) Good for diffusers (1) Excellent (2)	Molded to size (1) Good (1) Excellent but for ...ed only (1)	None (1) Excellent (1)
Stoneware	Poor (1) Satisfactory (1) 400° (1)	Poor (3) Satisfactory (1)	Poor to Fair (1) Good (3)	Nil (1) Poor (2) Satisfactory (1)	Very Poor (1) Poor (2) Satisfactory (1)
Bronzes	Good (1) 450° (3) 450–550° (1)	Good (2) Excellent (3)	Poor (1) Fair (1) Good (3)	Good (2) Excellent (3)	Good (2) Very good (2) Excellent (1)
Chrome plated cast iron	450° (1) 450–500° (2)	Fair (1) Good (2)	Variable (1) Good (2)	Fair (1) Good (2)	Poor (1) Fair (1)
Duriron	Fair (2) 450° (2) 450–500° (1)	Poor (3) Good (1)	Good (2) Excellent (3)	Very poor (1) Poor (3) Not machinable in ordinary sense (1)	Very poor (1) Poor (3) Good (1)
Hastelloy alloys ABC	Satisfactory (1) Good (1) Over 1,000° (2)	Good (2) Excellent (3)	Good (2) Excellent (3)	Poor (1) Satisfactory (1) A—Good (3) C—Poor (1) B—Good (3) C—Poor to Fair (2)	Poor (1) A—G Satisfactory(1) B—G Good(1) C—F
Lead, antimonial	Poor (250°) (2) 250–300° (1) 300° (1) Good (1)	Good (4) Excellent (1)	Poor (2) Variable (1) Fair (1)	Fair (1) Good (3) Excellent (1)	Fair (1) Good (3) Excellent (1)
Monel	Satisfactory (1) Good (1) 800° (2) 800–900° (1)	Good (2) Excellent (3)	Good (3) Excellent (2)	Good (2) Excellent (3)	Good (2) Very good (2) Excellent (1)
Stainless 304	Satisfactory (1) Good (2) Excellent (1) Grades may be selected for service over 1,000° (1)	Good (2) Excellent (3)	Good (3) Excellent (2)	Good (2) Excellent (3)	Good (2) Very good (2) Excellent (1)
Stainless 316	Satisfactory (1) 1,000° (3) Good (1)	Good (2) Excellent (3)	Good (2) Excellent (3)	Good (2) Excellent (3)	Good (2) Excellent (3)

Construction Materials fo

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THE INCREASING tendency on the part of the chemical process industries to accomplish fluid stage reactions under vacuum has greatly increased the interest and activity in the use of jet pumps. This primarily is due to the development of techniques employing high vacuum with low temperatures, as an aid to maintaining molecular stability in many processes such as the production of asphalts and heavy crudes from petroleum, and in the retention of vitamins during food processing.

Since jet pumps can move practically anything that will flow, the list of applications for jet pumps includes many different services for many different industries. Jets are employed as ejectors, injectors, syphons, wet or dry mixers, eductors, exhausters, backwashers, blowers, compressors, absorbers and scrubbers.

Steam-jet vacuum pumps operate on the kinetic principle. Steam expanding through a nozzle has its pressure energy converted to velocity energy. The high velocity jet of steam issuing from the nozzle entrains the air or gases to be removed, and the mixture of gas and steam enters the converging end of a diffuser where its velocity energy is converted into pressure sufficient to discharge at a pressure higher than maintained at the suction.

When a single-stage vacuum pump will not provide sufficient capacity or vacuum, two or more ejectors can be arranged in series as a multi-stage vacuum pump.

…criterion?

…xt page.

Numbers in parentheses ( ) tell number of manufacturers giving same rating.

…exibility of Design	Comparative Price Practicality	Remarks
…2)	Poor (1) Good (1)	Generally suitable only for non-working parts. (1)
…(1) …o good (1) …(1)	Unsatisfactory (1) Good (3)	As a molded material, consistence may not be maintained in tolerances of replacement parts (1)
…o good (1) …(2) …ent (1)	Good (2) Excellent (3)	Temperature for nozzles is 338° on blind suction, but practical temperature of 400° is possible by removal of heat by feed vapors. (1) Must be armored to prevent mechanical breakage. (1)
…(2) …o good (1)	Fair (1) Good (2) Excellent (1)	Must be armored to prevent mechanical breakage. (1) Not suitable for nozzles. (1)
…(3)	Poor (2)	Whole new ejector must be obtained for replacement. (1) Not suitable for nozzles. (1)
…(3)	Poor (1) Fair (2) Good (1)	
…ent (4)	Good (2) Excellent (3)	Oxides cannot form. Poor life. (1) Will not cover corrosive range of non-metallics. (1)
…(1) …(2)	Poor (1) Fair (1)	Same thickness of plating cannot be relied upon. (1) Penetration of pores is inevitable. (1) Will not cover corrosive range of non-metallics. (1)
…(4)	Poor (1) Fair (2) Good (1) Excellent (1)	Has limited use as must be ground. (1) Must be ground. Very brittle. (1) Has limited use in jets. (1) Will not cover corrosive range of non-metallics. (1)
…o excellent (1)	Fair (2) Fair to excellent (1) Good (1) Excellent (1)	Can't retain oxides. (1) Will not cover corrosive range of non-metallics. (1)
…(2) …(1) …ent (2)	Fair (1) Good (3) Excellent (1)	Suitable only for coatings or linings of non-working parts. (1) Not good due to erosion. (1) Subject to erosion and flow under pressure. (1)
…(1) …ent (3)	Good (2) Excellent (3)	Oxides cannot form. Poor life. (1) Will not cover corrosive range of non-metallics. (1)
…(1) …ent (3)	Good (2) Excellent (2)	Oxides cannot form. Poor life. (1) Will not cover corrosive range of non-metallics. (1)
…(1) …ent (3)	Poor (1) Good (1) Excellent (3)	Will not cover corrosive range of non-metallics. (1) Can't retain oxides. (1)

…fœt Pumps

There are two main fields of application for jets: (1) As high vacuum pumps for the chemical process and manufacturing industries; usually dry steam provides the motive power. (2) As ejectors for the transfer of gases, liquids, or slurries; these may use steam or a liquid as the motive power.

High-Vacuum Pumps

Vacuums possible with a jet, range from 3 in. Hg abs. for single-stage jets; down to 0.4 in. or 0.5 in. Hg abs. for two-stage units; 1 mm. to 10 mm. for three-stage units; 500μ to 3 mm. for four-stage units; and 100μ to 500μ for five-stage units. Vacuums are always calculated at absolute pressures to obviate adjustments for the different altitudes at which the jets may be operated, and the units are always exhausted to atmospheric pressures. Inter-condensers of barometric or surface type are frequently specified for two, three, four and five stage units to reduce steam consumption so that larger quantities of vapor can be handled than would be economically possible without condensers. The factors determining the size of the units are the lb. per hr. of intake vapor handled and the degree of vacuum required. Capacity is generally expressed on a weight basis (lb. per hr.) rather than a volumetric (cfm.) basis, and may vary from 1 to 5,000 or more lb. per hr.

Although jet pumps are employed in most modern stationary and marine power plants to remove non-condensable gases from the condensers, corrosion in such installations is not ordinarily a problem. However, as jet pumps are finding great use in the chemical, pharmaceutical, fatty oil and petroleum processing industries, serious corrosion and erosion problems must be faced. High velocities of jet streams, even when carrying only minute amounts of entrained acids or bases, cut away the oxides which often serve as protection against corrosion and thus reduce the effectiveness of the pump design or wear away the parts altogether.

Critical Criteria

Although jet apparatus can be made of any machinable material, few materials of construction meet the requirements for jet pumps operating under certain corrosive conditions, and one of the chief advances in the industry has been the employment of new materials which meet the rigorous conditions imposed. The qualities which such materials must possess are:

Heat resistance—The limiting factor is ability to withstand the temperatures and pressures of the nozzle steam. This will usually vary from 250 deg. F. to approximately 1,000 deg. F. However, the majority of corrosive industrial services are designed for operation with dry steam as the motive power at temperatures under 350 deg. F.

Resistance to Thermal Shock—The greatest thermal shock takes place in the nozzle at time of startup, when the nozzle is heated almost instantly from room temperature to operating temperature. Nozzle materials must be able to withstand this rise without cracking or spalling.

Diffusers must withstand the stress of variation in temperatures between the upper opening of the diffuser and its exit. In a high-vacuum stage the variation may be from 0 deg. F. to 150 deg. F.

Resistance to Erosion—The steam in a jet pump travels at velocities approaching 3,500-4,500 fps. (2,400-3,000 mph.). Resistance to erosion

Corrosion resistance of jet pump materials, rated by their producers for the conditions o op

Except as stated in footnotes, ratings represent resistance when chemicals are in combination with air, wet by steam, rations

CAUTION: Read general notes below, before using table E—Excellent G—Good S—Satisfactory F—Fair V—Variable P—Poor N—Not recommended	Acetic Acid	Acetic Anhydride	Alum	Aluminum Chloride	Aluminum Sulphate	Amines	Ammonia	Ammonium Chloride	Ammonium Phosphate	Ammonium Sulphate	Benzol	Boric Acid	Bromine	Calcium Chloride	Calcium Hypochlorite	Carbon Tetrachloride	Carbonic Acid	Chloracetic Acid	Chlorine	Chromic Acid	Citric Acid	Copper Sulphate	Fatty Acids	Ferric Chloride	Ferric Sulphate	Ferrous Sulphate	Formaldehyde	Formic Acid	Hydrocarbons (aliphatic)	Hydrocarbons (aromatic)	Hydrochloric Acid	Hydrofluoric Acid	Hydrogen Peroxide	Lactic Acid	Phenol
Acidseal E, Saniprene	G	G	E	E	E	V	G[9]	E	E	E	P	E	—	E	E	P	—	—	G[10]	P	E	E	V	E	E	E	E[12]	G	—	—	E	P[13]	—	G	—
Hard rubber	S	S	S	S	S	—	S	S	S	S	—	S	—	S	S	—	S	—	S	—	S	S	S	—	S	S	S	S	—	—	S	S	P[7]	S	—
Haveg 41	G	P	E	E	E	P	P	E	E	E	G	E	P	E	P	E	E	G	E	P	E	E	E	E	E	E	E	E	E	E	P	G	G	E	G
Haveg 48	G	P	E	E	E	P	P	E	E	E	G	E	P	E	P	E	E	G	E	P	E	E	E	E	E	E	E	E	E	E	E	G	G	E	G
Haveg 60	E	G	E	E	E	E	E	E	E	E	E	E	P	E	G	E	E	G	E	P	E	E	E	E	E	E	E	E	E	E	E	P	G	E	G
Karbate	E	E	E	E	E	E	E	E	E	E	E	E	V	E	G	E	E	E	F	V	E	E	E	E	E	E	E	E	E	E	E	E	G	E	E
Neoprene	G	—	S	—	S	—	S	S	S	P[3]	S	P[4]	S	S	V[5]	P[6]	S	—	P	P[4]	S	S	S	S	S	S	S	—	P[8]	P[8]	S	S	P[4]	—	P[8]
Porcelain	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	P	S	S	S
Pyrex No. 7740	E	E	E	E	E	—	G	E	—	E	E	E	E	E	G	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Stoneware	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Triflex	V	—	E	E	E	V	F	G	G	E	P	E	—	E	V	P	E	—	V[10]	P	G	E	V	G	E	E	E[13]	V	—	—	E	P[14]	—	—	—	—
Bronze, aluminum	G	G	G	V	G	V	V	V	V	V	G	G	V	G	V	G	G	G	V	V	G	G	G	P	P	V	G	G	G	G	V	V	P	G	V
Bronze, 8 percent phosphor	F	F	G	P	G	F	P	P	F	F	E	E	P	F	P	F	F	P	P	P	F	G	E	P	P	F	E	F	E	P	E	P	N	F	G
Cast iron	N	N	N	N	N	—	P	GP	V	V	P	N	—	GP	G	P	N	N	P	P	N	N	N	N	N	N	—	N	P	P	N	N	N	N	—
Duriron	E	E	E	G[14]	E	E	E	E[14]	E	E	E	E	P[14]	E	E	E	E	E	P	E	E	E	E	P	E	E	E	E	E	E	G[14]	P	E	E	E	E
Hastelloy A	G	G	G	F	G	E	E	G	G	G	E	E	P	G	P	G	E	E	P	P	E	P	E	P	P	G	E	E	G	E	G	F	P	P	E
Hastelloy B	E	E	E	E	G	E	E	G	E	E	E	E	P	E	E	E	E	E	P	P	E	P	E	P	P	E	E	E	E	E	E	E	G	G	E
Hastelloy C	E	E	E	E	G	E	E	E	E	E	E	E	F	E	G	E	E	E	G	F	E	G	E	F	G	E	E	E	E	E	E	F	G	G	E
Inconel	G	E	FG	F	G	E	E	F	G	G	E	G	P	P	P	GV	E	P	P	P	VF	G	E	P	G	VF	G	PF	E	E	VP	P	G	P	E
Lead, antimonial	P	P	G	P	G	P	G	P	G	G	G	P	P	P	P	V	P	P	P	V	P	G	P	P	G	G	P	P	P	P	P	V	P	P	P
Monel	G	G	G	G	G	F	F	FG	FG	G	E	G	P	E	V	E	F	G	VG	P	G	FP	GE	P	P	F	E	FG	GE	GE	VG	E	G	E	E
Stainless 304	E	G	E	F	G	G	E	P	E	E	E	E	P	P	P	V	E	P	P	G	G	E	G	P	G	G	E	G	E	E	P	P	E	P	E
Stainless 316	E	E	E	G	E	G	E	P	E	E	E	E	P	P	P	V	E	P	P	G	E	E	E	P	G	E	E	G	E	E	P	P	E	P	E

[1] At these velocities, protective oxides cannot be maintained on surfaces of the material of construction. [2] While the line pressure of the steam will be 40 to 300 psi. (286 to 422 deg. F.) heat is exchanged for velocity in the jet, and the intake vapor also may cool the steam so that operating temperature of the expanded jet in a single stage unit will be only 100-250 deg. F. Operating temperature of the expanded jet in the first stage of a two-stage unit is 50-150 deg. F. Operating temperature of the expanded jet in the first stage of a three-stage unit is 0-80 deg. F. [3] Has swelling effect on Neoprene. [4] Has oxidizing effect upon Neoprene. [5] To 16 deg. Be. at room temperature. [6] To 50 deg. Be. [7] Attack may be expected on hard rubber. [8] Hard rubber is gradually attacked. [9] To saturation at atmospheric pressure for wet ammonia. [10] To saturation at atmospheric pressure for wet chlorine, or wet sulphur dioxide. [11] To 50 percent concentration. [12] To 40 percent concentration. [13] Variable at all temperatures if fluorine impurities present. [14] Durichlor preferred over Duriron.

GENERAL NOTES:

Acidseal E, Saniprene, and Triflex data are supplied by B. F. Goodrich Co. with the following note: The ratings of these three linings are based on static corrosion resistance data and should not be considered as recommendations for use when subjected to corrosive wet vapors traveling at velocities of 2,500-3,000 fps. At such speeds we would expect cavitation and erosion to be the controlling factors rather than corrosion. Resistance ratings have been assigned with maximum temperature of 150 deg. F.; satisfactory resistance can often be obtained up to 212 deg. F. with shortened service life.

Hard rubber data are supplied by American Hard Rubber Co. with the following note: Hard rubber is not a suitable material for handling above solutions by steam jet because of softening effect at high temperatures. Ratings are for compressed air jets only.

Haveg data are supplied by Haveg Corp. with the following note: We have evaluated Havegs 41, 60, and 48 materials. We have not evaluated Haveg 43 or 63 because we do not recommend these two materials for use in vacuum jets because of the excessive abrasive wear which results.

Karbate impervious graphite data are supplied by National Carbon Co.

Neoprene data are supplied by E. I. du Pont de Nemours & Co. with the following note: We believe that Neoprene could be used in the application of protective coatings to various parts of the jet pumps to prevent corrosion of the metal surfaces. Gaskets made of Neoprene could also be used to seal the joints between various parts of the pump. Neoprene compositions retain their resilient properties for long periods at temperatures as high as 250 deg. F. Between 250 and 300 deg. F. Neoprene products gradually harden and lose their flexibility. In general, the deterioration will increase with temperature.

Porcelain data are supplied by Lapp Insulator Co. with the following note: Porcelain rated for above as valve or piping material and not as material for steam jets. Porcelain will not stand up under wet steam, distilled water or high velocities. Generally speaking, porcelain has the chemical resistance of glass, and like glass is useful for all acids except hydrofluoric but is not generally used for caustics. Considerations in planning porcelain jobs have to do with mechanical conditions and temperature conditions. The chemical resistance of the Porcelain is uniform.

Pyrex No. 7740 data are supplied by Corning Glass Works with the following note: We do not have information on the resistance of glasses to erosion under these (jet service) conditions. Under static or near static conditions the corrosion resistance of No. 7740 glass to neutral or acid solutions is extremely high at temperatures up to 250 deg. F., except in the case of fluoride containing solutions. The attack by alkaline solutions increases with increasing pH and, of course, with temperature. Attack by amines will depend on the particular amine in question and attack by ammonium phosphate is questionable. The organic compounds with neutral or acid reaction should have no harmful effect on No. 7740 glass.

Stoneware data are supplied by General Ceramics & Steatite Corp. and by U. S. Stoneware Co. with the following note: Chemical stoneware is not only resistant

unit was achieved by balancing parts at close tolerances in the fabricator's test laboratory, the replacement parts must match the original tolerances very closely if this interbalance and efficiency is to be maintained. Otherwise the entire unit will have to be shipped back to the fabricator for rebalancing—an expense and inconvenience to the user. Materials which do not lend themselves readily to reproduction in precise tolerances, such as molded parts that shrink from mandrels in setting, therefore are disadvantageous as jet pump materials.

Survey of Materials

A survey of ejector manufacturing member companies of the Heat Exchange Institute has been made by the author. It reveals that materials of construction for corrosive conditions of service are limited chiefly to six nonmetallic and eight metallic is therefore one of the critical conditions to be met, since erosion results almost entirely from the supersonic velocities of the jet. This condition may be considerably aggravated if the motive steam is not entirely dry. The cutting power of a jet of wet steam is sufficient to bore through a steel plate placed between the nozzle and the diffuser.

Resistance to Corrosion—Even in minute quantities, corrosive liquids or gases in jet streams are highly destructive, and many chemicals, such

ditions o operation.

y steam, rations, traveling at 2,500-3,000 fps.,[1] at 0.250 deg. F.[2]

Hydrochloric Acid	Hydrofluoric Acid	Hydrogen Peroxide	Oxalic Acid	Phenol	Phosphoric Acid	Sodium Bisulphate	Sodium Carbonate	Sodium Chloride	Sodium Hydroxide	Sodium Hypochlorite	Sodium Nitrate	Sodium Sulphate	Sodium Sulphide	Sodium Sulphite	Sodium Thiosulphate	Stearic Acid	Sulphur	Sulphur Dioxide	Sulphuric Acid	Sulphurous Acid	Trichlorethylene	
E	F[3]	—	G	—	E	E	E	E	E	E	E	E	E	E	E	—	—	E[10]	E[11]	E	—	Acidseal E, Saniprene
S	S	P[3]	S	—	S	E	S	S	S	P[3]	S	S	S	S	S	S	S	S	S[9]	S	P	Hard rubber
E	P	G	E	G	E	E	E	P	P	P	E	E	P	E	E	E	E	E	E	E	E	Haveg 41
E	E	G	E	G	E	E	P	E	P	P	E	E	P	E	E	E	E	E	E	E	E	Haveg 48
E	P	G	G	G	E	E	E	E	E	P	E	E	E	E	E	E	E	E	E	E	E	Haveg 60
E	E	G	E	E	E	E	E	E	E	F	E	E	E	E	S	P	E	E	E	E	E	Karbate
S	S	F[3]	—	F[3]	S	S	S	S	S	S	S	S	—	—	S	S	S	S	S	S	P[3]	Neoprene
S	P	S	S	V[10]	P	P	S	S	P	P	P	P	P	P	P	S	S	S	S	S	S	Porcelain
E	P	E	E	E	E	V	E	V	V	E	E	P	G	E	E	E	E	E	E	E	E	Pyrex No. 7740
E	P	E	E	P	E	E	E	P	E	E	E	E	E	E	E	E	E	PE	E	E	E	Stoneware
E	F[3]	—	—	E	E	E	E	E	V	E	E	E	E	E	—	—	—	E[11]	—	—	—	Triflex
G	V	P	G	V	V	G	G	G	G	V	G	G	P	G	G	G	P	V	V	V	G	Bronze, aluminum
F	G	P	F	P	E	E	E	G	P	E	E	P	P	G	P	E	P	F	P	F	F	Bronze, 5 percent phosphor
N	—	N	N	N	N	G	GP	G	N	GF	GF	GF	GF	GF	N	N	P	P	N	N	P	Cast Iron
E[14]	P	E	E	E	E	E	G	E[14]	E	E	E	E	V	E	E	E	P	E	P	E		Duriron
E	E	G	G	E	G	E	E	E	P	P	G	P	P	F	E	E	P	G	P	P		Hastelloy A
E	E	E	E	E	E	E	E	E	P	P	E	F	G	E	E	E	P	G	P	E		Hastelloy B
E	G	G	E	G	E	E	E	E	G	G	E	G	G	G	E	E	G	G	G	G		Hastelloy C
G	G	P	G	GF	G	G	G	GV	VF	P	G	G	GE	G	G	E	F	P	VF	P	EV	Inconel
P	P	P	P	F	G	P	P	P	P	P	V	V	V	F	V	P	P	V	G	V	P	Lead, antimonial
G	E	G	E	E	G	E	E	E	E	VF	G	E	GE	F	G	GE	FG	P	GE	P	E	Monel
E	E	E	E	E	E	G	E	G	E	P	E	E	P	F	F	E	P	P	P	P	F	Stainless 304
E	E	E	E	E	E	G	E	G	E	P	E	E	V	G	G	E	F	F	P	F	G	Stainless 316

but proof against the corrosion of all acids with the exception of hydrofluoric, phosphoric containing fluorides, and strong caustic. However thermal shock, if severe, might disqualify some of these applications. Resistance of chemical stoneware to thermal shock cannot be evaluated by means of a formula or by imposing certain temperature limitations as the resistance will depend to a large extent upon the type, size and shape of equipment.

Bronze (aluminum) data are supplied by Chase Brass & Copper Co. with the following note: It is quite difficult to predict with absolute certainty the performance of any alloy in various solutions since factors influencing corrosion vary so greatly. However, the attached information should be of considerable value in that it provides an indication of the various chemicals in which aluminum bronze as well as other copper base alloys may be used.

Bronze (phosphor) data are supplied by American Brass Co. with the following note: We have no corrosion data covering the severe conditions to be expected in a jet pump where the material will be exposed to a corroding solution containing air and steam at high velocities. The ratings given are based on the generally expected corrosion resistance of tin bronzes to the various chemicals.

Cast iron data are supplied by Crane Co. with the following note: In general, our experience is based on the performance of cast irons corresponding to ASTM Designation A-126, Classes A and B. Between these two classes as we make them there are no significant differences in corrosion resistance when they are used in our products. The same thing might not be true if the same two materials were used in jet pumps, although would expect that it would be true.

Duriron data supplied by The Duriron Co., with the following note: For a number of chemicals a preference for Durichlor over Duriron has been indicated. Durichlor is similar to Duriron in chemical composition with the exception of the addition of approximately 3 percent molybdenum and 1 percent manganese which increases the resistance to hydrochloric acid and other chloride solutions.

Hastelloy alloys A, B, C data are supplied by Haynes Stellite Co.

Lead (antimonial) data are supplied by National Lead Co. with the following note: We feel that chemical lead or chemical lead with tellurium is not suitable for this type of construction. Antimonial lead has been used successfully in the construction of steam jets, but its use is limited. Antimonial lead can be used for suction chambers without any further protection, and it may also be used for the diffuser sections provided these are in turn lined with some other material such as Karbate, electrode carbon or high silicon iron. Antimonial lead cannot be used for steam nozzles or as diffusers because the lead would wear out too rapidly due to the erosion by moisture in the vapors.

Monel and Inconel data are supplied by The International Nickel Co.

types of material. These are Karbate impervious graphite, glass, porcelain, Haveg, hard rubber, stoneware, stainless steels 304 and 316, bronze, monel, high-silicon iron, chrome plated cast iron, Hastelloy alloys (A,B,C,) and lead. In the first table (p. 114) the combined judgment of the leading fabricators has been compiled with respect to seven of the necessary qualities of performance. The second table (to the left) considers an eighth criterion, corrosion resistance; these data were obtained in a survey of the manufacturers of materials, who rated their own products.

In the nonmetallic group Karbate impervious graphite, porcelain, glass and Haveg seem to be the most frequently used.

The tables indicate that Haveg is good in most qualities but low in temperature limit. Impervious graphite has a high comparative heat resistance and is excellent in its resistance to thermal shock, erosion and corrosion, and also in its machinability to close tolerance. Porcelain has excellent chemical resistance in those highly oxidizing conditions of service that impervious graphite and Haveg do not meet, but is difficult to hold to critical tolerances. Pyrex has a lower resistance to thermal shock and physical shock in the opinion of fabricators, and nozzle pressures therefore must be limited to 70 psig. (316 deg. F.); a part can be used only for the precise service and rating for which it was prepared and if eroded in any one part the entire unit must be replaced. The other qualities of Pyrex are excellent.

The metals with the exception of high silicon iron, chrome plated cast iron and lead are generally excellent in all qualities, but they are subject to corrosion to a far higher degree than are the nonmetallics.

Ejectors

While the greatest number of jet pumps are manufactured for use in the high-vacuum field, there are many other important applications. The materials of construction and physical properties applying to high-vacuum pumps apply equally to ejectors. Ejectors are classified according to motive power and character of material entrained. For each classification, factors affecting materials of construction selection are as follows:

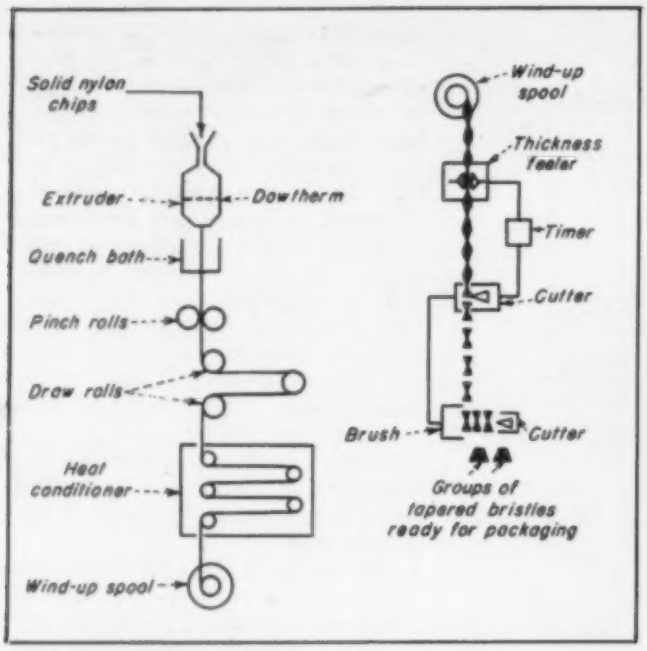
Steam or Gas to Move Gasses—Pumps in this category are employed as vacuum pumps, low pressure blowers and jet compressors.

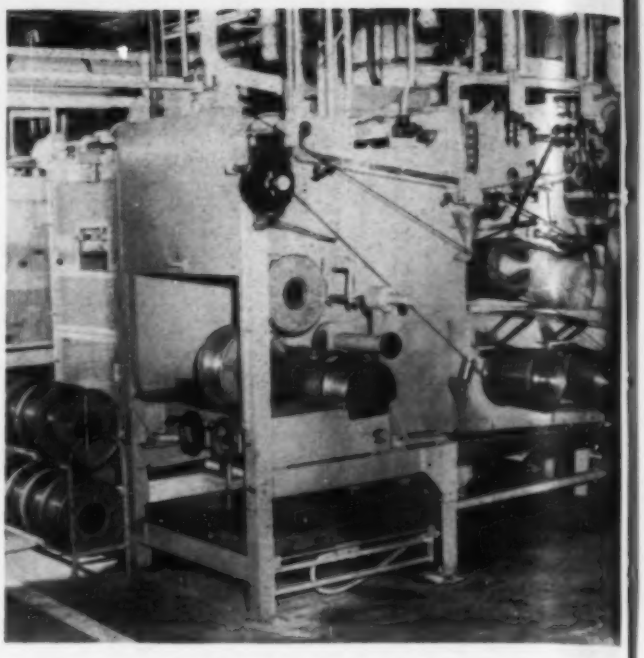
(*Continued on page 248*)

as chlorine, caustic soda, or hydrochloric acid, when in combination with wet steam gain even more corrosive effect. Jet parts may be exposed to almost any corrosive chemical in its combination with steam. New materials of construction are constantly being evolved, and recent improvements enable jet pumps to last months or years instead of days.

Machinability—Ready machinability is necessary to meet the precise designs required for efficient operation. The manufacture of diffusers is largely empirical, for fundamental information is comparatively unavailable on reactions of streams at supersonic velocities. Manufacturers have evolved diffuser designs and assembly relationships, however, which can be balanced efficiently if the construction materials are machinable to close tolerances.

Maintenance to Close Tolerances in Replacement Parts—Jet parts will eventually need replacement, and since the efficiency of the original

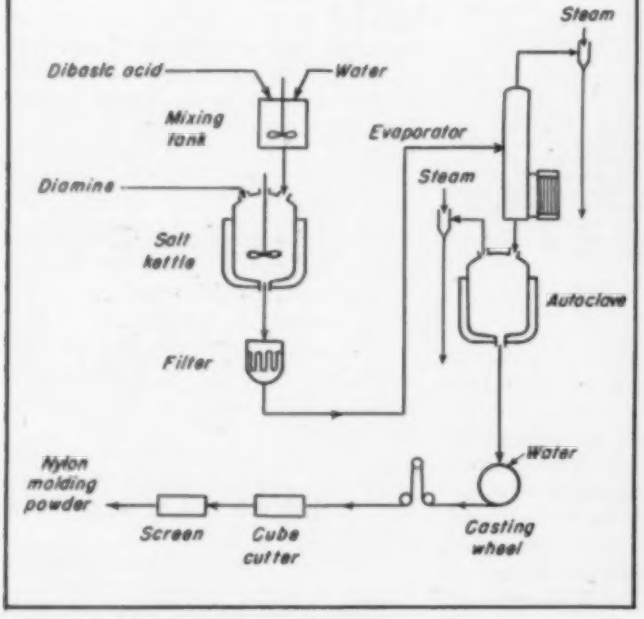


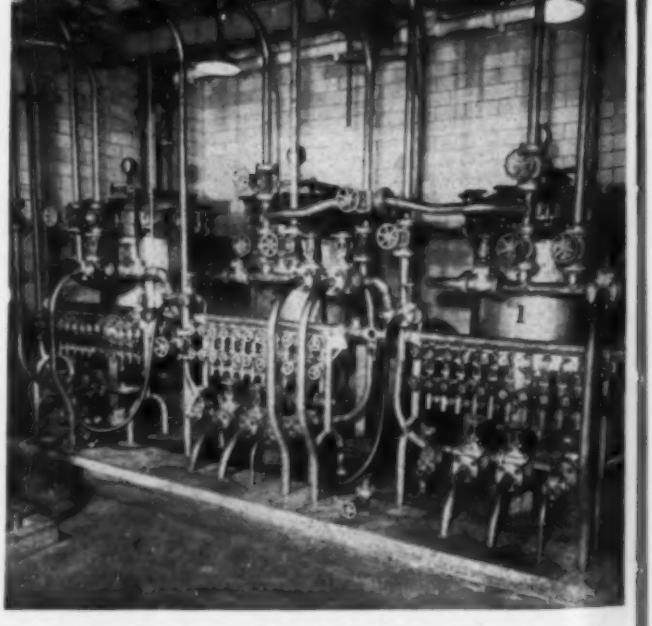


NYLON MONOFILAMENTS, both level and tapered, are one of the major products at Du Pont's new Washington Works. For producing both types, key machines are the extruders shown above beside process diagram. They're mechanical marvels.

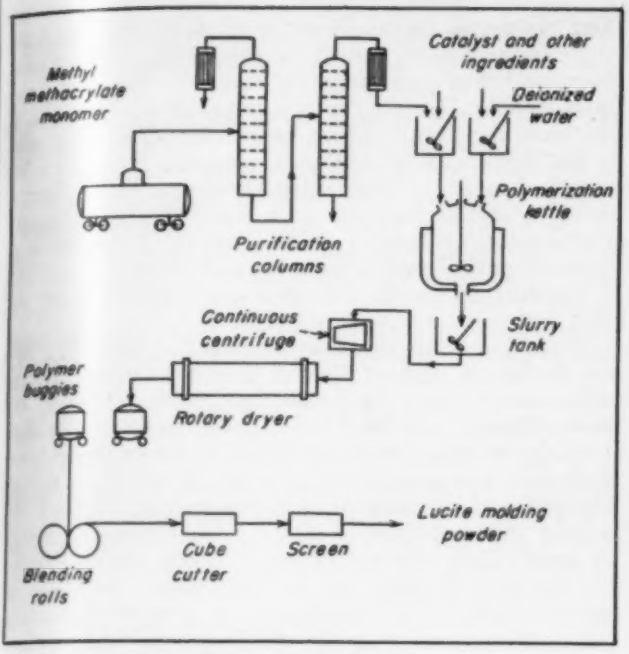
How Washington Works

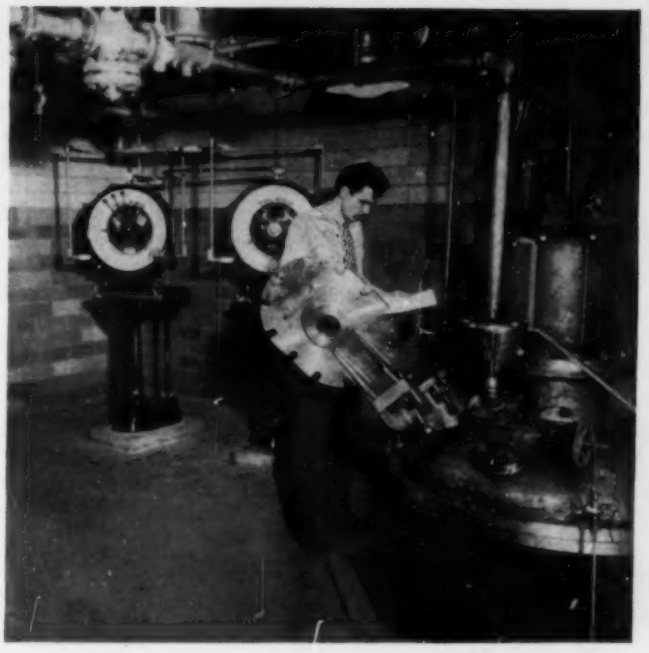
Du Pont's gleaming new Washington Works produces three products: nylon monofilaments, acrylic molding powder and nylon molding powder. Here, in an exclusive story, is how each process works.





NYLON MOLDING POWDER, the third main product, starts with reaction of a diamine with an acid to produce nylon salt solution. This, after removal of decolorizing carbon in filters shown above, is ready for the second step, evaporation . . .





ACRYLIC MOLDING POWDER is the second major product. The process, an emulsion polymerization, is diagramed above. Adjacent photo shows the heart of the unit, the polymerization kettle. It operates batchwise but is fully automatic.

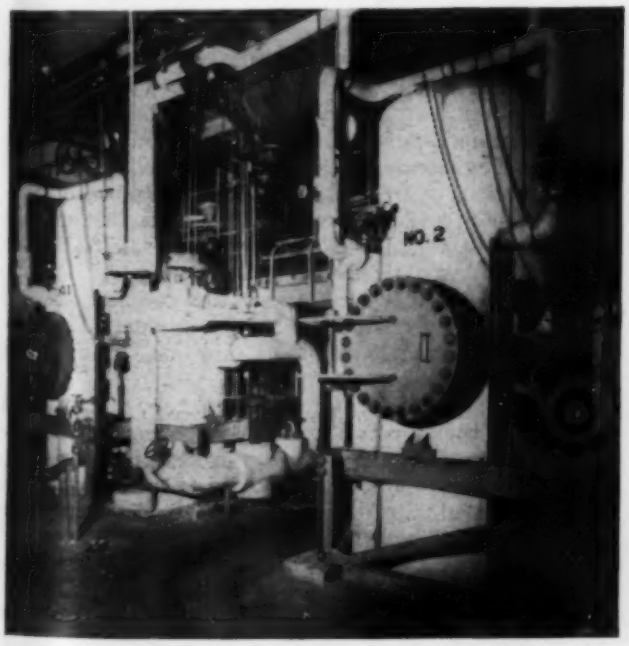
Roger Williams, Jr.
Assistant Editor
Chemical Engineering

Tough, strong nylon and the crystal-clear acrylics are familiar materials to most of us. Both these plastics (and nylon is a plastic, too, not just a thread for stockings) are getting a boost with the operation of Du Pont's newest plastics venture—the big, new Washington Works, outside of Parkersburg, W. Va. This new plant contains the first major nylon plastic plant and a big new Lucite acrylic resin molding powder plant. Nylon monofilaments are also made there, and a new unit will soon produce polythene molding powder.

Manufacture of these plastics, and their fabrication into such finished forms as monofilaments is a fascinating blend of chemical and mechanical engineering. In the polymerizations, chemical engineering is in the forefront. In extrusion of tapered nylon monofilament for paint brushes, mechanical engineering steps ahead.

Nylon Process

Production of nylon starts with a dibasic acid and a diamine. The acids used at Washington Works are pri-



. . . These Conkey evaporators concentrate the dilute salt solution for the final leg of the process, polymerization in the autoclaves shown at far right. Molten nylon polymer is extruded from the bottom, cast on a wheel and cube cut.

marily adipic and sebacic acids. The primary diamine is hexamethylene diamine. First step in the manufacture is the reaction of the acid and amine to produce a salt, so-called nylon salt. The acid, which is solid, is first dissolved in water in a stainless steel, agitated vessel called a salt kettle. This vessel is water jacketed to remove the heat of reaction. Then the diamine is slowly added, at such a rate that temperature rise can be controlled, until the proper quantity to react with the acid has been put in. Control is by pH of the liquid contents.

The product of this reaction is a dilute solution of nylon salt, hexamethylene diammonium adipate, in water. The dilution is just enough to prevent crystallization at atmospheric temperatures. To give the future polymer better color and guard against impurities, this solution is next slurried with activated carbon and filtered through a Niagara type pressure filter.

Next step is concentration of the salt solution. This is done in a stainless, Conkey type evaporator, heated with 250 psig. steam. Operation is batchwise. The highly concentrated salt solution from the evaporator then feeds by gravity to the autoclaves.

In the autoclaves the final removal of solution water and the polymerization occur. These units are small stainless steel kettles which are jacketed and have internal cooling coils. They are heated with Dowtherm. The cycle involves first heating the solution to remove the remainder of the water. When the salt is up to a given temperature polymerization begins. The molten salt is held at this temperature as polymerization goes on to completion. Water formed in the condensation type polymerization is continuously removed through a vacuum condenser. When the polymer has reached the desired molecular weight, measured by viscosity, the reaction is stopped by cooling the polymer down to just above its melting point. The finished polymer is then ready for removal.

To get the polymer out of the autoclave, a flush valve in the bottom of the unit is opened and inert gas pressure is applied within the vessel. Unlike most polymers, molten nylon has quite low viscosity and is easy to get to flow from the kettle. But there is one problem: molten nylon discolors readily on exposure to air. This is solved by quenching the stream of polymer with water just as it comes out of the valve.

The extrusion valve is slotted so that the nylon comes out of the autoclave in the form of a ribbon. This ribbon drops onto a chilled wheel, called a casting wheel, as it comes out. It solidifies on this wheel to a thin flexible ribbon. The ribbon is then dried and passed through a cube cutter, thus producing the final molding powder product, when no colors or additives are required.

Casting and cutting machines are separate and move on tracks below the series of autoclaves. Hence only two of each of the machines are needed to supply the battery of autoclaves.

Some of the nylons produced at Washington Works, nylons tailor-made for specific applications, require additives such as colors and plasticizers. These are dry-blended in a conical blender and then homogenized by passing through a Royle extruder and cube cutter.

Nylon Monofilament

Conversion of nylon polymer into level and tapered monofilaments is one of the most fascinating things done at Washington Works. It is fascinating because it required the ingenuity of the best mechanical brains in Du Pont. In producing tapered filament, the thin thread as it comes from the extrusion machine must be alternately thick and thin and then thick again at controlled intervals. Then the long continuous filament must be cut at just the maximum and minimum spots, and all the thin ends put in the same direction before packaging and sending to the paint brush manufacturer. To do the job required development of machines the likes of which have never before been seen.

The first step is the extrusion machine. The solid nylon is melted under pressure, using Dowtherm vapor. Then it extrudes several filaments at a time, through a nozzle. Because there is tension on the threads, the nylon is in essence "pulled" out the nozzle. As it leaves the nozzle it is immediately passed through a water quench bath and then between a pair of pinch rolls.

It is these pinch rolls that produce the taper. The rolls are alternately speeded up and slowed down so that the nylon coming from the nozzle first comes out faster, and hence thinner; and then more slowly, and hence thicker.

Next the nylon has to be drawn to orient the polymer molecules and gain greater strength. Drawing an uneven filament without breaking the thin sections, and yet still getting sufficient drawing of the thick sections, is a trick in itself. Then the continuous filament goes through a conditioning chamber and is continuously rolled up on spools. The spooling equipment is so arranged that switching from one spool to another can be accomplished without interruption of the process, and without loss of material.

Bristle Cutting

Now the problem is the cutting of the continuous filament into short lengths of tapered bristle. The spool is unwound through a mechanical "feeler" that measures the thickness, activates a solenoid which then causes a cutter to come down and cut the thick-thin thread at exactly the thick portion. These cuts, with thick ends and a thin center, continue down a conveyor and are automatically brushed off at right angles onto another conveyor belt. In this direction an operator can pick them up in bunches, and by holding the ends of each bunch put them into a machine which cuts the bunch in the middle. Hence small bunches of bristles are obtained which are tapered with the thin ends all at one end of the bunch. These are then trimmed and packaged.

Lucite Process

The story of polymethyl methacrylate production takes us back to the field of the chemical engineer. It begins with the receipt of methyl methacrylate monomer from the Du Pont Ammonia Department plant at Belle, W. Va., in tank cars. The monomer, which has been inhibited against polymerization, must first have the inhibitor removed. This is done in a two-step distillation. In the first still, the monomer is the tails and any impurities left, such as acetone, are taken off overhead. In the second still the monomer is distilled over, leaving the inhibitor and any high boiling impurities in the tails product. The pure monomer then goes to a hold-up tank for feeding to the polymerization system.

The polymerization unit is completely automatic in operation. Typical with all the plant's operations, all the operator has to do is push a button to start the cycle going. Once in motion, the several ingredients are automatically measured out into dissolving tanks, and the dissolving tanks are then emptied into the polymerization kettle.

The polymerization vessel is a jacketed, stainless kettle which is agitated with an anchor-type agitator. The first part of the cycle consists in heating the charge to polymerization temperature by injecting steam into the jacket. Then when reaction begins, water is admitted to the jacket to remove heat of reaction and give a constant temperature

polymerization. At the end of the cycle, the emulsion of polymer and water is cooled to stop reaction and is dropped by gravity into a slurry tank below the polymerization kettle. Note that up to this point all materials movement in the polymerization system has been by gravity.

Slurry of polymer particles in water is next pumped to a continuous Bird centrifuge. The wet solids from the centrifuge feed into a rotary dryer, made of highly polished stainless steel. This polish is necessary for cleaning, when changing from one formula polymer to another. Finished polymer from the dryer drops into a polymer "buggy." These are small vessels mounted on detachable legs which can be moved around the plant by means of hoist trucks.

Polymer Handling

The buggies fulfill another function—they are also blenders. Many Lucite formulations require additives, and, of course, color in many cases. Additives are put into the buggy which is then placed on a set of rolls and turned over and over until the ingredients are completely blended. The buggy is then moved directly over the hopper that feeds the polymer milling rolls.

Milling of the polymer is set up to require minimum attention by operators. At the end of the milling, the polymer is fed through cooling baths and a cube cutter. From the cube cutter the product falls directly into the fiber drum shipping container.

Polythene

In a few months the polythene unit of Washington works will go into operation. In this plant, uncompounded polyethylene made at Du Pont's Sabine River works at Orange, Tex., will be compounded and colored for final shipment. The process will consist of mixing the ingredients in large conical blenders and then passing the mixed material through Plasticators for compounding. The extruded ribbon from this extruder will then be cube cut and packaged in bags.

The auxiliaries at Washington Works are also of interest. Because of the requirement for extreme clarity in Lucite, the water used in the polymerization must be extremely pure. To achieve that, the plant's raw well water is passed through an ion-exchange unit. This unit is equipped with sodium fluoride addition for complete silica removal.

Steam Production

The plant's steam requirements are met by two 50,000-lb. per hr. boilers. They are of the spreader stoker type with continuous discharging travelling grates. They produce saturated steam at 250 psig. The plant's electrical requirements are purchased, with the exception of a small amount of direct current which is generated on the plant.

The amount and complexity of the instrumentation at Washington Works deserves mention. Although almost all of the process operations are done batchwise, automatic control has been built into all of them. Cycle timers, automatic high temperature cutoffs, pressure and temperature controls are included on essentially all units. Control of the Lucite polymerization was mentioned above. The other processes work in similar fashion.

Major reason for this extreme instrumentation is to get uniformity of product—a real necessity in the plastics business. Byproduct values, however, include reduction of labor costs and elimination of as many human errors as possible.

The nylon monofilament equipment is another example of the application of automatic controls. On the extrusion machines, production rate changes mean changing the speed on dozens of rolls and spools, and not all the changes are a constant proportion. This is particularly true of the rolls which draw or stretch the filaments. Speed changes here have to be such as to maintain the same draw. All these changes have been so automatically built into the machines that practically no effort is required to change from one production rate to another.

The entire plant is an excellent example of the useful application of automatic control in a chemical plant.

A Showplace Plant

Requirements for product purity at Washington Works led to completely enclosed buildings, filtered hot air heating, adequate summer ventilation. From this, beauty of architectural design came naturally. Buildings are brick with tile interiors. Architecture is modern yet functional. The auxiliary buildings, like the office building shown here, lend a modern, clean appearance to the whole plant.

Materials of Construction

Few of the materials used at Washington Works are by their nature corrosive. The materials of construction problem was not one of prevention of corrosion, but was one of maintaining purity and clarity of the product. Hence all equipment which touches the product in any way is made of stainless steel, most of it Type 347.

Provision of stainless equipment helped the purity problem, but there was another requirement to be met. In both the Lucite and nylon plants, several formulas of polymer are being made. Whenever a change is made, the requirement of purity means that every piece of equipment must be washed thoroughly free of the previous batches. To facilitate the washing, all equipment has been specially designed for easy cleaning. That meant specially designed cube cutters that would open quickly, wash easily; it meant that most of the equipment interiors are highly polished to prevent hold-up of material on rough walls. All in all, it meant some real design problems.

In layout and architectural design the plant has been designed as a "showplace." All buildings are brick, and interiors are lined with two-tone tiling. Equipment is painted with harmonizing colors. Besides the operating buildings, the plant also has an office building, an employment office, a cafeteria, and a medical building. The entire plant has been laid out with a view to growth. By the end of 1948 employment will be up to 500. Expected early expansion will add to that figure in the future.

EDITORIAL VIEWPOINTS

Sidney D. Kirkpatrick and Staff

Glycerine From Petroleum

For a dozen years Shell Development Co. has been engaged in the creation of a new chemical industry based on allyl chloride and related compounds. Laboratory processes had been developed and even prior to the war pilot plants had demonstrated the successful synthesis of a number of basic derivatives. But many perplexing chemical engineering problems stood in the way of full-scale design and production. Under the pressure of war activities, the program was postponed to become Shell Chemical's No. 1 postwar project.

This month appropriate ceremonies in Houston marked an exceedingly important milestone in this pioneering program. On September 16 President Jan Oostermeyer formerly opened the world's first plant for the commercial production of synthetic glycerine. With a capacity equal to approximately a fifth of the national prewar output of this essential chemical, the Shell achievement is of important economic as well as technical significance. Synthesis of glycerine from petroleum provides a new and reliable source of supply. It forever frees the user from dependence upon a byproduct of other industries. And, given time, ample quantities can be produced to meet any conceivable demand.

Because this outstanding accomplishment in basic research, process development and engineering design typifies so strikingly the sort of group effort for which the Award for Chemical Engineering Achievement was established in 1933, the committee of distinguished educators, under the chairmanship of Professor-Emeritus Alfred H. White, has selected the Shell Development Co. as the recipient of the 1948 award. Presentation will be made at a subscription dinner to be held in the Waldorf-Astoria Hotel in New York City on Wednesday, November 10, 1948. You are invited to share with us and the committee in the pleasure of presenting this recognition to a group that has contributed so much to the advance of chemical engineering in industry.

A Two-Way Street

Process industries are naturally interested in chemical education, and for many years the more progressive chemical companies have been doing something about it. Some have encouraged their younger employees to go back to college for more education—and have paid all or part of their salaries while they study. Technical men in high industry posts gladly give their time to serve on visiting committees and advisory boards for various colleges and universities.

Now Monsanto has gone a step farther along this two-way street. Recently this company announced that it will employ young teachers for a full year of industrial experience and then let them return to their academic endeavors. They will receive the salary normally paid for the jobs to which they are assigned and, in addition, the necessary travelling expenses for themselves and their families. In this way it will be possible for these young teachers to get first-hand knowledge and experience that will help them prepare their students more adequately for work in the chemical industry.

In a sense the program has two benefits. It should improve the quality of technical education in those institutions that cooperate in making the plan work. That helps the university. But more than that, it will improve the quality of the chemists and chemical engineers coming from those schools. That helps Monsanto and the whole chemical industry which will hire these graduates. That the plan is commendable is obvious. We can only hope that others will follow Monsanto's lead.

"Reasonably Foreseeable"

In a recent employer liability case the Supreme Court has given us a new gage of management responsibility. This decision places the burden of responsibility for worker safety on the basis of "reasonably foreseeable hazards." This means that critical review is needed for every part of every manufacturing establishment. If there is any chance that one may anticipate accidents, then it becomes management's responsibility to reduce that chance to a negligible minimum. Fortunately, humanitarian reasons, good employee relations, and lower long-time costs all point to this same need for careful planning. For more evidence that safety pays, see page 189 of this issue.

Stockpile Competition

Uncle Sam is again taking more seriously the need for building a stockpile of strategic and critical materials. Three difficulties have been incurred which deserve notice: (1) Some of the critical materials are not available either because of genuine scarcity or because of restriction of supply from foreign sources; (2) Congress has not always encouraged stockpile building with generous appropriations, but that now seems to be an almost negligible difficulty; (3) most serious is the problem of buying materials which are currently so scarce as to be unavailable in adequate quantity for current commercial usage.

Chemical enterprises process most of the strategic and critical materials. They often find, therefore, that they are buying in competition with Uncle Sam. There appears no way in which to avoid that complication, at least no way generally applicable. But there is one important, although often neglected, opportunity for our executives.

We refer to the need for keeping military and procurement officials conversant with the industrial situation. It is not enough to stay at home and complain. One may not rightly blame military and purchasing officials if they are never told what are the needs of industry and how they may be fitted into the stockpile program to the long-time benefit of both government and industry. It would be worthwhile to have visits of thoroughly competent executives and engineers in Washington to be sure that the government agents know how their programs may affect, either currently or for long-time purposes, the business of interested industries.

We cannot justifiably demand that the government do no buying for the stockpile. But we can reasonably ask that this buying be coordinated constructively for the mutual benefit of both. Especially we can demand that the government purchasers do not rush into the market at untimely moments in a way that merely pushes up prices for goods which both government and industry must buy.

Honorable Intentions

DETERMINATION of whether or not a material is an economic poison within the meaning of the Federal Insecticide Act of 1947 may depend "upon the purposes for which it is intended." The following quotation from Interpretation 3 of the Insecticide Act regulations deserves careful consideration of other branches of the chemical industry.

"When an article has both economic poison and non-economic poison uses, it is considered to be an economic poison if it is marketed in channels of trade where it presumably will be purchased as an economic poison. This provision is to be interpreted reasonably and in the light of market conditions in the particular places where the product is to be sold. It is not the purpose to require a product to be registered and labeled as an economic poison merely because a few persons, on their own initiative, purchase an insignificant portion of the product distributed through the particular channel of trade, for economic poison uses. On the other hand, if it is known to the distributor or is common knowledge that a considerable portion of the product in the channel of trade concerned is actually being used as an economic poison, it will be considered as being intended for use as an economic poison."

Specific examples are cited in which determination of intent will be governing—among them caustic soda, kerosene and phenol. Manufacturers and distributors of comparable chemicals having dual uses should applaud this earnest attempt of the Department of Agriculture to interpret the evident spirit rather than the confusing letter of the law.

Re-Employment Rights

THE Selective Service Act of 1948 reiterates the re-employment rights of the young men taken under the draft. In fact, some believe that the new law establishes for draftees even more generous provisions than prevailed in wartime.

No one will deny that all of us must seek to reduce the business risk to a minimum for those taken for service to the country. No thoughtful man in industry wishes to ignore that responsibility.

But the very existence of the responsibility creates a number of management problems that are going to be peculiarly difficult to meet in process industries which operate continuously. There is only one simple generalization which we have heard that seems to make sense. We must treat these draft absentees very much as if they were on an extended vacation. We must keep a suitable spot open for their re-employment, and we must schedule our whole personnel program as much in the interest of the draftee as we do for those suffering from illness or absent on regular vacations.

A Winning Contest

GENERAL MOTORS has recently published a little booklet called "The Worker Speaks." In it are the top 40 prize-winning letters in GM's contest—"My Job and Why I Like It." This contest, unique in American industry, resulted in almost 175,000 entries, 58 percent of the eligible employees. The competition was well worthwhile and the top letters, printed unedited, are a moving picture of the feelings of employees.

More than that, the letters tell a story that every production man and every employer should read. As GM's president, C. E. Wilson, has written, "Every manager, every man who is responsible for supervising the work of others, should read and study these letters carefully. No one can read and study them without gaining a better insight into the minds and thoughts and aspirations of the people in the plants, laboratories and offices. They give a further realization of the importance of understanding and cooperation on the part of supervision. They are in themselves an education for supervisory people."

We not only agree with Mr. Wilson; we strongly urge supervisors in process industries to enroll for the same kind of education. Copies of the booklet can be obtained from the Department of Public Relations, General Motors, Detroit 2, Mich. But whether supervisor or supervised, the letters are worth reading. For one thing, they affirm our belief in the benefits of the American system of free enterprise and extend our understanding of how it works in practice.

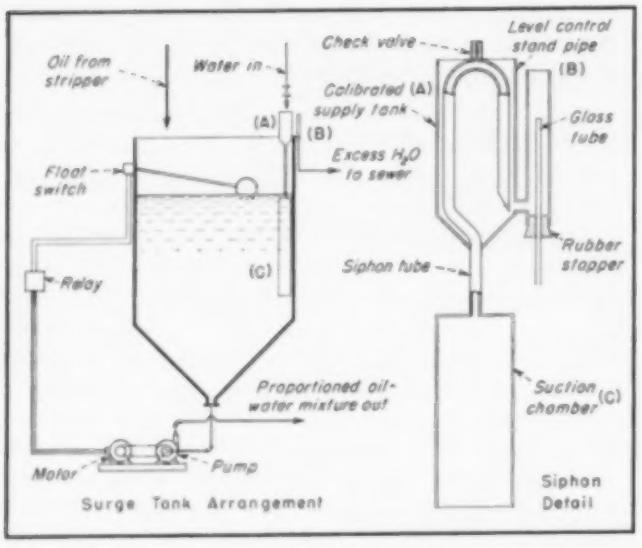
A Greater Inducement

JOHN LEWIS and the Interstate Commerce Commission are jointly making it more important for recurring reviews of fuel and power economics. The cost of an energy unit in any form is now so high that even small power and process-steam users can profitably sharpen their pencils for careful recalculations.

Just now there is a third factor which is even more compelling. This is the threat of interrupted fuel supply because in many areas demands during the coming winter are bound to exceed total supply. It may even be necessary to interrupt or postpone some of the less urgent plant operations during cold spells since coal, gas, and electricity will be given priority for household and small-use applications. Plans for systematic cutback in fuel consumption may prove good insurance against disaster in case your plant is suddenly shut down by fuel shortages.

THE PLANT NOTEBOOK

Theodore R. Olive, ASSOCIATE EDITOR



Low Cost Proportioner for Liquids Works Automatically Without Attention

ROY W. BARNS
Chemical Engineer, Detroit, Mich.

July Contest Prize Winner

ACCURATE proportioning of liquids is a problem very common in the chemical industry. Its achievement, especially where corrosive liquids are used, can involve expensive and sometimes intricate devices requiring constant maintenance and adjustment.

The device shown here has a single moving part and can be built of practically any material that corrosion resistance demands. While the ingredients are handled batchwise they are introduced continuously and automatically, and the whole system can be inserted in a continuous process.

This proportioner here is somewhat crude and open to refinement but in its present form it has been accurately proportioning water into a vegetable oil for over three years. During this time it has required little attention and very slight maintenance. It cost less than $10.

Its use calls for a pumping arrangement which is not uncommon in the chemical field. It is best described by an example.

A vegetable oil is discharged from a stripping tower into a surge tank from which it is pumped intermittently at the dictates of a float controlled switch which stops and starts the surge pump when the oil in the tank reaches fixed levels. As a result of the characteristics of this type of control, a definite volume of oil is pumped from the tank each time the pump kicks on.

The next step in the process requires that a definite weight (volume) of water be added to the oil as a prelude to a degumming operation. The device described does this by taking advantage of the changes in level in the surge tank.

It consists of a calibrated supply tank A equipped with an adjustable overflow arrangement B. A pipe bent in the form of an inverted U is fixed inside of it. One leg of the U extends through the bottom of the supply tank. The other end of the U extends down to within an inch or two of the bottom of the tank. This end is given a rather acute bevel. At the top of the U there is a short nipple in which a light check valve of the ball type is mounted. The leg which extends through the bottom of the tank is attached to a vacuum chamber *C*.

The device is hung over the side of the tank in such a way that the vacuum chamber is completely immersed in oil when the float switch starts the pump. An excess of water has been fed into the standpipe and is overflowing at a fixed level at this time.

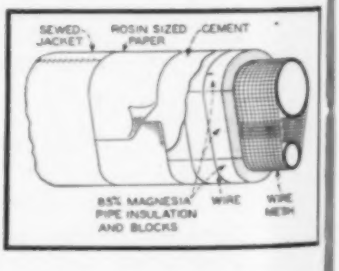
When the tank level is drawn down a suction is built up in the vacuum chamber that eventually causes liquid in the supply tank to siphon over into the surge tank. The vacuum is broken when the liquid level in the supply tank reaches the bevel and the action stops.

When the surge pump stops and the tank starts to fill, air is expelled by the rising oil level and leaves via the check valve. In time the tank is filled to a point where the pump kicks on again and the cycle is repeated.

Thus each time the surge tank is pumped out between the levels set by the float switch a definite quantity of water is added to a definite quantity of oil. The proportions may be changed by adjustment of the water overflow pipe as well as at the float switch.

Insulating Steam Heated Piping

SEVERAL suggestions to improve the insulation of steam-traced and steam-wrapped piping have been advanced by the Magnesia Insulation Manufacturers Association. In steam tracing a steam line of an inch or less diameter is run parallel to the line to be heated, while in steam wrapping, the steam line is wrapped spirally around the process line. In either case the insulation should surround both pipes completely.



The sketch illustrates the method of handling a steam-traced line, showing half sections of semi-cylindrical molded pipe insulation, each half appropriate for its respective line, fitted around the two pipes, with blocks of the same thickness carefully fitted into the side spaces. In some cases it is desirable first to wrap the pipes in wire mesh as shown. The insulation pieces should be tightly butted and firmly fastened with

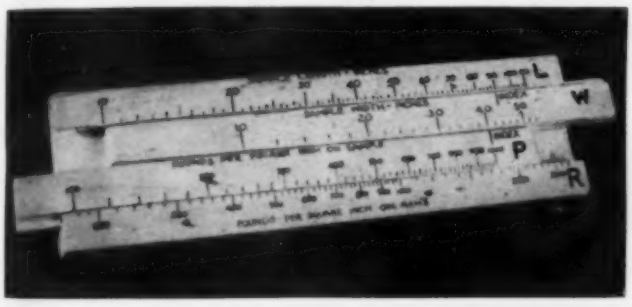
$50 Cash Prize For a Good Idea!

Until further notice the editors of *Chemical Engineering* will award $50 cash each month to the author of the best short article received that month and accepted for publication in the Plant Notebook. The winner each month will be announced in the issue of the next month: e. g., the September winner will be announced in October and his article published in November. Judges will be the editors of *Chemical Engineering*. Non-winning articles submitted for this contest will be published if acceptable at our usual space rates.

Any reader of *Chemical Engineering*, other than a McGraw-Hill employee, may submit as many entries for this contest as he wishes. Acceptable material must be previously unpublished and should be short, preferably not over 300 words, but illustrated if possible. Articles may deal with any sort of plant or production "kink" or shortcut that will be of interest to chemical engineers in the process industries. In addition novel means of presenting useful data, as well as new cost-cutting ideas, are acceptable. Address Plant Notebook Editor, *Chemical Engineering*, 330 West 42nd St., New York 18, N. Y.

iron wire, all joints being pointed with asbestos cement. The entire outer surface should be covered with a layer of cement reinforced with hexagonal wire mesh and troweled to a smooth hard finish.

With steam-wrapped pipe the piping should be covered with a layer of galvanized expanded metal lath, laced with iron wire, over which an appropriate size of segmental or semi-cylindrical pipe insulation is applied as in any insulation job. In either case, depending on operating conditions, various finishes may be used.



Slide Rule Easily Made for Converting Ram to Sample Pressures

JAMES R. BOTHEL
Chemical Engineer, Plywood Research Foundation

In the use of hydraulic presses for different materials or under various pressing conditions, it is necessary to convert the pressure on the rams to the pressure on the sample.

The usual way of finding the required ram pressure is by graphs or calculations (e.g., *Chem. Eng.*, Jan. 1948, p. 135); however, the slide rule described here offers a much easier and faster solution to the problem.

The following equation is used to find the ram pressure corresponding to a desired sample pressure: Ram pressure × ram area = sample pressure × sample area. Since sample area is length × width, therefore log ram pressure + log ram area = log sample width + log sample length + log sample pressure. But, since ram area is constant:

Log ram pressure = log sample width + log sample length + log sample pressure minus a constant.

A rule with two slides was constructed as in the illustration, and four logarithmic scales laid out on it with the maximum press capacity at the right edge of the bottom scale. It is then easy to determine the relative positions of the three other scales so that all calculations fall within the range of the rule. The scale chosen should have an accuracy comparable to the pressure gage being used.

The constant value of the ram area is most easily included by locating the index for one of the sliding scales empirically.

The press for which this rule was made has six 21-in. rams, 54x104-in. platens, and ram pressures to 2,700 psi. This gives a platen pressure of 1,000 psi.

Working backwards on the rule, the 1,000 on the bottom slide (P-scale) should be opposite the 2,700 on the

August Prize Winner

A $50 prize will be issued to

Adam A. Reeves

U. S. Bureau of Mines, Oil-Shale Demonstration Plant
Rifle, Colo.

For an article describing a readily constructed sampler for gas which collects a sample representative of both the composition and the total flow of the gas in the main line.

This article is the winner of our August contest.

This article will appear in our October issue. Watch for it!

Water Cooling Speeds Battery Charging

When it became necessary for the battery operated industrial trucks of the Reynolds Alloy Co., Listerhill, Ala., to operate on a 24-hr. per day schedule, a system was worked out to accelerate re-charging and thus permit the trucks to operate on a three-shift basis with only two sets of batteries per truck. The charging racks are constructed in the form of long concrete pits with individual cool well-water sprays installed under each charging position. The cooling prolongs the life of the 54 Gould batteries, eliminates the need for a third set for each truck and allows faster charging.

Dimensions of Sch. 40 Welded and Stainless Steel Pipe, With Factors for Flow Velocity and Reynolds Number

Nominal Pipe Size, In.	Outside Diameter, Ft.	Nominal Wall Thickness, Ft.	Inside Diameter, Ft.	Transverse Area (Internal)[1] Sq. Ft.	U. S. Gal. per Lin. Ft.	Mult. Factor, Cu. Ft./Min. to Ft./Sec. Vel.	Mult. Factor, Lb./Min. Water to Ft./Sec. Vel.[2]	Mult. Factor, Ft./Sec. to Reynolds No.[3]	Mult. Factor, Cu. Ft./Min. to Reynolds No.[3]
⅛	0.03375	0.00567	0.02242	.0003947	0.0029526	42.232	0.67733	2,079.9	87,833
¼	0.04500	0.00733	0.03033	.0007265	0.0054346	23.064	0.36991	2,814.4	64,909
⅜	0.05625	0.00758	0.04108	.0013256	0.0099162	12.574	0.20166	3,811.8	47,925
½	0.07000	0.00908	0.05183	.0021101	0.015785	7.8988	0.12668	4,809.2	37,986
¾	0.08750	0.00942	0.06867	.0037030	0.027700	4.5008	0.072186	6,371.1	28,674
1	0.10958	0.01108	0.08742	.0060018	0.044897	2.7771	0.044540	8,110.8	22,523
1¼	0.13833	0.01167	0.11500	.010387	0.077700	1.6046	0.025736	10,670	17,121
1½	0.15833	0.01208	0.13417	.014138	0.10576	1.1789	0.018908	12,448	14,675
2	0.19792	0.01283	0.17225	.023303	0.17432	0.71526	0.011472	15,982	11,431
2½	0.23959	0.01692	0.20575	.033248	0.24871	0.50130	0.0080401	19,090	9,569.5
3	0.29167	0.01800	0.25567	.051338	0.38408	0.32466	0.0052071	23,721	7,701.1
3½	0.33333	0.01883	0.29567	.068659	0.51360	0.24276	0.0038935	27,433	6,659.2
4	0.37500	0.01975	0.33550	.088405	0.66131	0.18853	0.0030238	31,129	5,868.6
5	0.46358	0.02150	0.42058	.13893	1.0393	0.11997	0.0019241	39,023	4,681.4
6	0.55208	0.02333	0.50542	.20063	1.5006	0.083077	0.0013324	46,894	3,895.6
8	0.71875	0.02683	0.66508	.34741	2.5988	0.047976	0.00076947	61,708	2,960.4
10	0.89583	0.03042	0.83500	.54760	4.0963	0.030437	0.00048817	77,474	2,358.0
12	1.0625	0.03383	0.99483	.77730	5.8146	0.021443	0.00034391	92,303	1,979.1
14 O.D.	1.1667	0.03642	1.0938	.93970	7.0295	0.017737	0.00028447	101,489	1,800.0
16 O.D.	1.3333	0.04167	1.2500	1.2277	9.1840	0.013582	0.00021783	115,978	1,575.1
18 O.D.	1.5000	0.04683	1.4063	1.5533	11.620	0.010730	0.00017209	130,483	1,400.0
20 O.D.	1.6667	0.04942	1.5678	1.9306	14.442	0.0086333	0.00013847	145,468	1,255.8
24 O.D.	2.0000	0.05725	1.8855	2.7922	20.887	0.0059693	0.00009574	174,942	1,044.2

[1] This is also the internal volume of the pipe in cubic feet per lineal feet. [2] Weight of water taken at 62.35 lb. per cu. ft. [3] Based on water having a viscosity of 1 centipoise and a specific gravity of 1.000. The weight of water per cubic foot is taken as 62.35 lb. For fluids other than water multiply the factor given in the table by the specific gravity compared to water, and divide by the viscosity in centipoises.

bottom (R-scale). The value 54 on the upper slide (W-scale) should be over the right index on the lower slide (P-scale). The index for the upper slide (W-scale) then has to be located under the value 104 on the upper (L-scale).

Because the scales are logarithmic, one rule could be used for several different presses merely by having a different index on the upper slide for each different ram area.

Level Gage for Paper Pulp

SINCE paper pulp is likely to block the lines of ordinary types of level gages, a new type has been developed by the research and development department of Australian Paper Manufacturers, Ltd., in collaboration with Prof. Brown, of the University of Melbourne. A pressure head, which is essentially a stainless steel diaphragm in contact with the stock, is mounted in the wall of the blow tank. The diaphragm carries an electrical device for translating pressure variations into electrical variations indicated on a meter. The same firm employs a novel conductivity arrangement for measuring the quantity of soda passing down the drain. Two measuring electrodes are situated in the drain system in such a way that the area immersed in the effluent is proportional to the rate of flow. Thus proportionate changes in conductivity result both from variations in soda concentration, and from the quantity of effluent.

Two Colors for Safety in Glass Plants

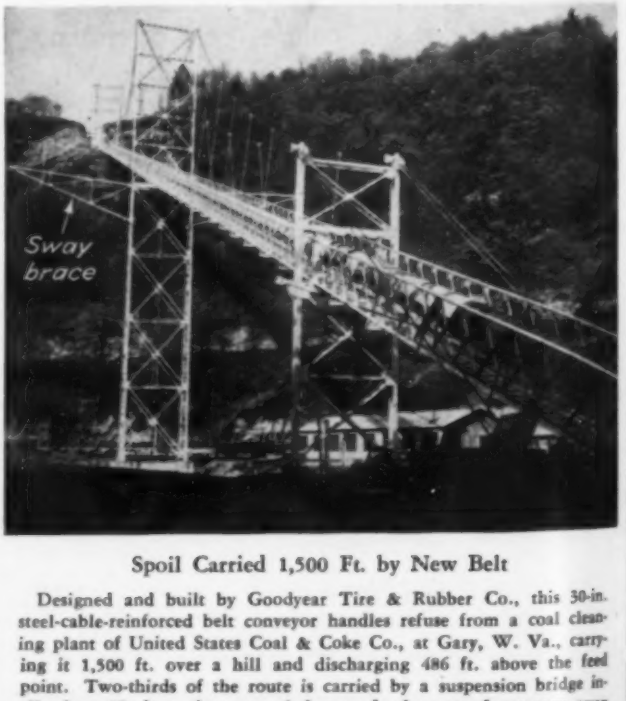
FOLLOWING extensive study, the factories of Libby-Owens-Ford Glass Co. have adopted two colors, fire red and safety yellow, as a simplified safety painting scheme. Fire extinguishers may sometimes be obscured by stacks of glass or other objects, so a standard 18-in. circle of fire red, with a white arrow pointing to the equipment and bearing the word "fire" in red, is placed high above each piece of fire-fighting equipment. The safety yellow, chosen because it has the highest visibility of any color, is used for painting all moving objects such as lift hooks, conveyor baskets, trucks and other mobile equipment. It is used for bordering truck traffic lanes, for cross hatching doors leading to hazardous areas and for indicating master control switches, handles and parts of machinery.

Tabulation for Schedule 40 Pipe Aids Flow Rate and Reynolds Number Problems

JAMES R. LORAH

Chairman, Department of Chemical Engineering
University of Missouri, Columbia, Mo.

QUICK calculation of fluid flow problems is facilitated by the accompanying tabulation, used in our classes at the University, in which certain factors usually not included in other tables are given. Based on Schedule 40 steel and stainless pipe, the tabulation gives dimensions, volume per lineal foot, and conversion factors for flow velocity and Reynolds number.



Spoil Carried 1,500 Ft. by New Belt

Designed and built by Goodyear Tire & Rubber Co., this 30-in. steel-cable-reinforced belt conveyor handles refuse from a coal cleaning plant of United States Coal & Coke Co., at Gary, W. Va., carrying it 1,500 ft. over a hill and discharging 486 ft. above the feed point. Two-thirds of the route is carried by a suspension bridge inclined at 19 deg. An unusual feature is the use of catenary sway braces attached to outriggers at the main supporting towers to prevent side sway in high winds. A corrugated metal hood protects the belt system from the weather.

REPORT

Inventory of Midwest Chemical Progress

With the advantage of prosperity in manufacturing and agricultural lines, the chemical process industries of the Midwest are spreading out in variety of products and in volume of output.

PASSING from the distributing influences of a wartime economy to a settled program of postwar progress, the chemical process industries of the Midwest are forging steadily ahead to account for a relatively higher share of the national value of output. By geographical license this report is defining the area as comprising all the North Central States with the exception of the Dakotas, namely: Ohio, Indiana, Illinois, Michigan, Wisconsin, Minnesota, Iowa, Missouri, Nebraska, and Kansas. In 1939 these states were responsible for nearly 29 percent of the total U. S. value of output for the chemical process industries. Because of the lack of complete Census data for any later period, exact comparisons can not be made but on the basis of employment figures the midwest now appears to have a 30 percent participation in the grand total.

Significant Growth

This rate of relative growth may not seem impressive but it becomes more noteworthy when viewed in the light of the vast nation-wide increase in activities since 1939 and the phenominal rise in the size and scope of the chemical industries on the Pacific Coast and in the Southwest region.

Many basic reasons may be found to account for the steady growth reported for the industries of the Midwest. In addition to strategical location, these states are rich in a varied line of natural resources including both mineral and agricultural. They have excellent rail transportation and terminal facilities with the lakes furnishing water delivery over a wide area. Economic electric power is readily available and an adequate supply of efficient labor is at hand. These ten states form an extensive community where the population is growing faster than the national average.

McGraw-Hill census of plants and employees in midwestern process industries. In

	Ohio		Indiana		Illinois		Michigan		Wisconsin	
	No. of Plants	No. of Employees	No. of Plants	No. of Employees	No. of Plants	No. of Employees	No. of Plants	No. of Employees	No. of Plants	No. of Employees
Drugs and medicine	25	2,414	15	5,277	28	9,406	14	7,875	4	472
Explosives and fireworks	4	1,275	3	195	5	700	2	145	2	261
Fertilizers	24	1,785	10	697	8	825	3	487	2	[illegible]
Glass and ceramics	207	45,310	73	15,766	88	18,585	34	3,850	10	1,700
Industrial chemicals	75	13,949	19	3,057	38	7,684	32	17,809	7	1,101
Leather, tanned, etc	8	1,892	5	393	21	6,674	14	2,757	17	3,445
Oils and fats	17	1,573	6	611	22	3,275	6	496	1	113
Paints and pigments	53	7,045	15	1,207	49	6,592	28	4,160	8	1,345
Paper and products	47	14,057	16	2,289	18	3,671	45	15,320	47	18,870
Petroleum products	27	8,420	10	10,715	24	8,918	23	1,913	6	264
Plastics	12	2,538	1	90	8	749	4	660	4	1,481
Rayon, synthetic fibers	3	993	..	.....	2	84	..	.....	..	.....
Rubber and products	25	73,109	7	12,277	5	1,980	3	9,500	1	3,000
Soap and cleansers	24	3,599	9	4,332	19	2,170	16	1,379	4	814
Othe process industries	98	18,424	49	11,240	112	28,198	47	7,117	26	4,837

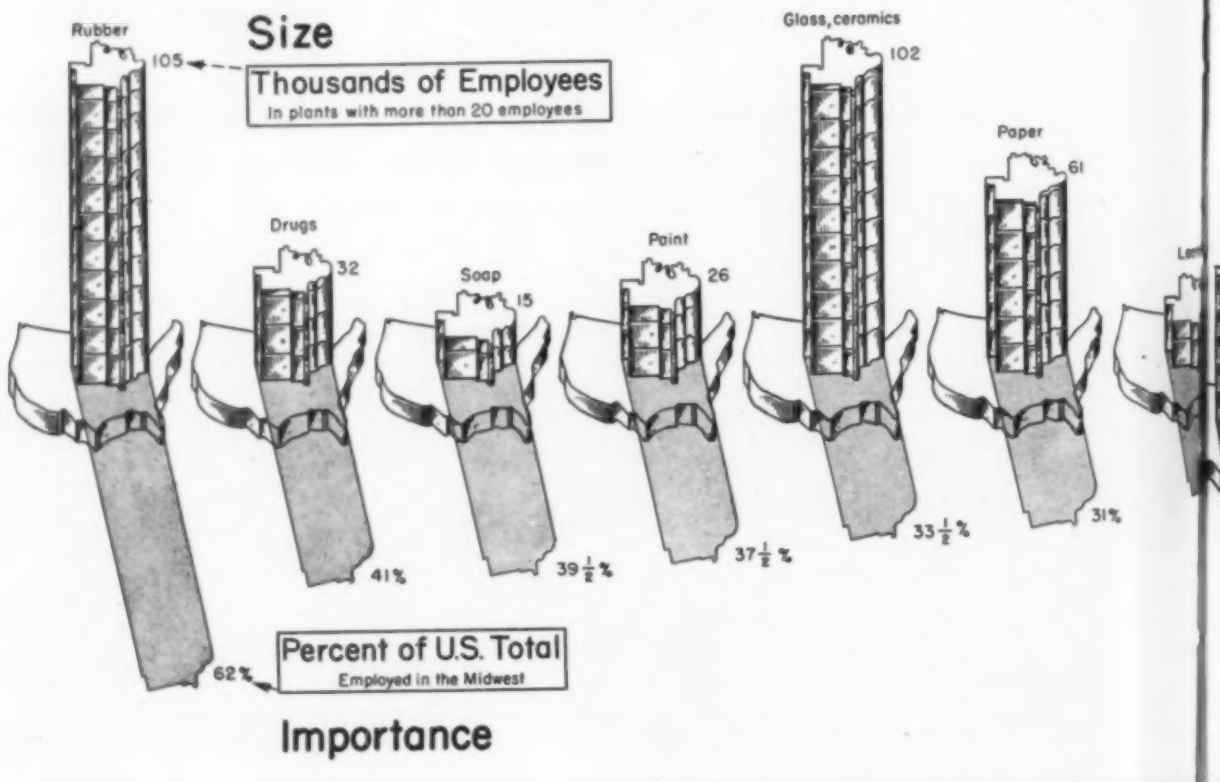
McGraw-Hill Census as of first quarter 1947. Plants having 20 or more employees.

The Census Bureau recently issued an estimate of U. S. population as of July 1, 1947, which indicated an increase of 8.9 percent over the 1940 figure. In contrast the ten midwestern states show a gain of 10.4 percent for the same period even though Nebraska actually reported a loss of 32,000.

Selected to house more than its representative share of war plants, the Midwest had the advantage of the additional activity they represented while they were in operation. Many of them were engaged in producing war materials and were closed when there was no longer demand for those materials. Others were so equipped that they could turn out products for civilian use. The Spencer Chemical Co. leased and later purchased the Jayhawk Ordnance Works at Pittsburg, Kan., and is using it to produce anhydrous ammonia for fertilizer consumption. Solvay Division of Allied Chemical & Dye Co. acquired the Buckeye Ordnance Works at South Point, Ohio, and also is producing ammonia for fertilizers. Part of the Missouri Ordnance Works at Louisiana, Mo., has been converted by the Bureau of Mines for the manufacture of synthetic liquid fuels. It is reported that a part of this plant will be moved to Houston, Tex., where it will be used to produce fertilizer chemicals with Hercules Powder Co. operating it on lease from the Army.

In addition to the new productive facilities obtained through the trans-

. . . Midwest casts long shadows—covering over half the nation's rubber production



...ow, figures are compared with U. S. totals. Held to this light, the . . .

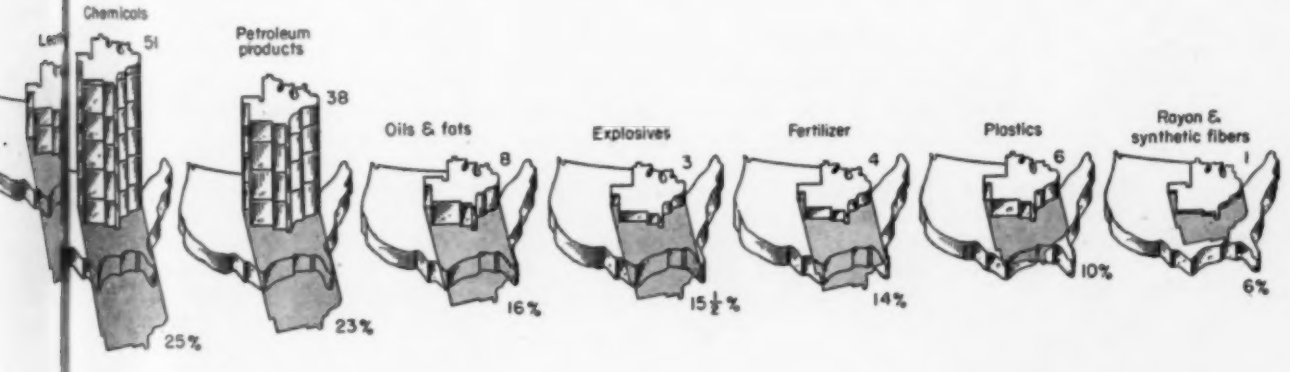
Minnesota		Iowa		Missouri		Nebraska		Kansas		
No. of Plants	No. of Employees	No. of Plants	No. of Employees	No. of Plants	No. of Employees	No. of Plants	No. of Employees	No. of Plants	No. of Employees	
4	717	5	563	23	4,756	5	251	3	192	.....Drugs and medicine
..	.....	1	39	3	468	..	.....	..	.....	....Explosives and fireworks
2	81	..	.....	1	40	1	325	..	.....	.....Fertilizers
12	5,068	22	1,836	31	8,375	2	98	11	1,007	.....Glass and ceramics
6	436	4	540	10	4,062	..	.....	13	2,010	.....Industrial chemicals
2	340	..	.....	3	242	..	.....	..	.....	.....Leather, tanned, etc.
6	686	10	559	4	300	1	30	4	225	.....Oils and fats
16	1,604	6	361	21	3,049	..	.....	2	420	.....Paints and pigments
8	4,838	4	484	6	686	..	.....	2	485	.....Paper and products
8	991	1	25	7	1,452	3	150	21	4,277	.....Petroleum products
1	70	1	549	1	70	..	.....	..	.....	.....Plastics
..	.....	..	.....	..	.....	..	.....	..	.....	.....Rayon, synthetic fibers
1	300	3	2,180	2	1,690	1	420	1	700	.....Rubber and products
2	83	4	366	11	869	..	.....	3	1,390	.....Soap and cleansers
28	3,586	15	2,836	45	8,063	10	1,830	9	1,234	....Other process industries

fer of government plants to private ownership, contracts for new plants for the chemical process industries in the Midwest totaled approximately $207 million from V-J Day through 1947. This amounted to upwards of 22 percent of the value of contracts placed for new processing plants in the entire country. These totals do not take into account the rehabilitation of plants through the installation of new equipment and it is known that this ran into large totals both in the Midwest and in other sections of the country.

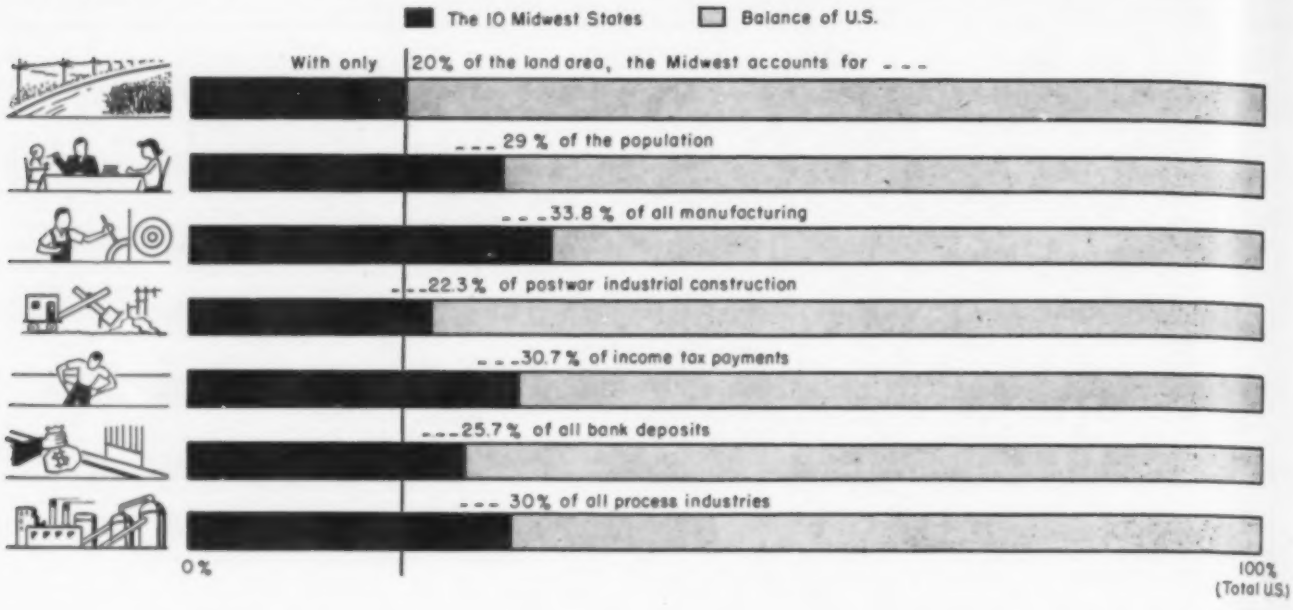
Some of the new plants were designed to produce chemicals which had not previously been marketed and to turn out new detergents, new insecticides, and new pharmaceuticals and drugs. However plant expenditures were not centralized but ran through the entire chemical list including mineral acids, alkalis, solvents, phosphorus products, and a long list of coal-tars. Incidentally more than one-third of U. S. coke-oven tar is produced in the midwest.

Although long holding a high rank as a supplier of agricultural products, the Midwest until recently was relatively unimportant as a producer and consumer of fertilizer. During the war, unprecedented demand for foodstuffs, high prices obtained for them, and pressure exerted to realize the government food program combined to stimulate use of fertilizer in all sections. What happened in the Midwest

...uction...urth of its paint, paper, leather, chemicals, drugs, soap and ceramics.



Per square foot, the Midwest supports more than its share of the national economy.


The 10 Midwest States
Balance of U.S.
With only 20% of the land area, the Midwest accounts for ---
--- 29 % of the population
---33.8 % of all manufacturing
---22.3% of postwar industrial construction
---30.7 % of income tax payments
---25.7 % of all bank deposits
--- 30% of all process industries
0%
100%
(Total US)

may be shown by the fact that in 1935-39 that area acocunted for less than 12 percent of national fertilizer consumption while in 1947 this percentage had risen to nearly 23. This sectional trend is still in evidence and makes clear that wartime influences have raised the midwestern fertilizer industry to a status that would have taken many years to reach under normal conditions.

Plant Expansion

Last December the National Fertilizer Association listed fertilizer plants built since 1940, or that were under construction or projected, including established plants that have increased their capacity 50 percent or more since 1940. Such expansions included: Illinois-Swift & Co., National Stock Yards and Calumet City; Armour Fertilizer Works and Illinois Farm Supply, East St. Louis; Schrock Fertilizer Service, Congerville; Buhner Fertilizer Co., Danville; American Agricultural Chemical Co., Fulton; and Illinois Agricultural Ass'n., Streator; Indiana-Longaker Mills, Butler; Baker Fertilizer Co., Hagerstown; Indiana Farm Bureau Co-op, Hartsdale and Indianapolis; Ellis Chemical Co., New Albany; and V. W. Norris & Son, Rushville; Iowa-National By-Products, National Fertilizer Co., and Pioneer Phosphate & Chemical, Des Moines; Virginia-Carolina Chemical Co., Dubuque; Consumers Co-op, Eagle Grove; International Minerals & Chemical Corp., Mason City; Ia-Conda Phosphate & Chemical Co., Perry; Michigan-Farm Bureau Services, Saginaw; Minnesota-Apple River Mill Co., Minneapolis; Minnesota Farm Bureau, St. Paul; Armour Fertilizer Works and Northwest Co-op Mills, Winona; Missouri-Missouri Chemical Co., Joplin; Missouri Farmers Ass'n., Springfield; Best Bros. Plant Food, St. Joseph; and Lange Brothers, St. Louis; Nebraska-Farm Fertilizers, Omaha; Ohio-Swift & Co., Cleveland and Greenville; Farm Bureau Co-op, Dayton; and Marion Plant Life Fertilizer Co., Marion; Wisconsin-Farm Co-op Plant Foods, Forkin Phosphate Co., and Northwest Co-op Mills, Green Bay; F. S. Royster Guano Co. and Swift & Co., Madison; Farm Co-op Plant Foods, Prarie Du Chien; and Wisconsin Plant Foods, Watertown.

Another direction in which wartime necessity forced expansion is in production of oil-bearing materials and vegetable oils and the Midwest was called upon to assume the greater part of this expansion. This has special reference to soybeans and flaxseed and the oils obtained from them. In addition to the sharp rise in domestic requirements, it was necessary to ship large amounts of oils and fats abroad. At the same time imports of oilseeds and oils dropped to insignificant figures. To meet this emergency the Midwest turned larger acreages over to flaxseed in order that linseed oil might play a larger part in easing the shortage of drying oils. For years the bulk of domestic flaxseed was produced in the Midwest and our requirements were rounded out by importing from the Argentine. More recently the Argentine has changed its export policy and it has become necessary for this country to become practically self-supporting. Hence the postwar outlook is that the Midwest will continue to be a large producer of flaxseed and that the western crushing mills will be more important in converting this seed into oil.

Soybean Production

A similar condition exists in the market for soybeans and soybean oil. The elimination of foreign copra and coconut oil brought pressure to expand supplies of domestic oils. Soybean oil gave the most promise and soybean acreage was pushed to a point where it was possible to more than triple the output of oil. In fact the acreage went up faster than crushing capacities. From 1942 to 1945 about 65 million bushels of soybeans grown in the Midwest were shipped to other sections of the country to be processed because Midwest crushing facilities were not adequate. Only last month announcements were made that the Glidden Co. will build a $3 million soybean extraction plant at Indianapolis and that Spencer Kellogg & Sons will erect a plant at Decatur, Ill., capable of handling 500 tons of soybeans a day. Hence production of vegetable oils promises to take a more prominent position in the postwar process industries of the Midwest.

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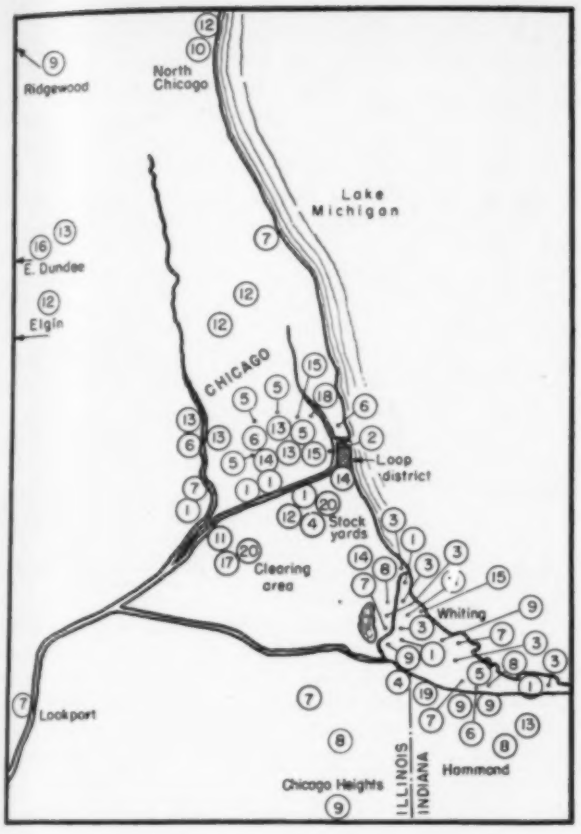


1. Gas, coke, tar products
2. Inks, dyes, colors
3. Pig iron, steel
4. Packing house products
5. Paint, varnish, lacquer
6. Paper, textiles
7. Petroleum refining and research
8. Lime, cement, gypsum, clinkered dolomite
9. Chemicals (acids, salts, organics)
10. Tantalum
11. Corn processing
12. Pharmaceuticals
13. Plastics
14. Rubber products
15. Soap, cosmetics
16. Ceramics
17. Glass
18. Leather tanning
19. Industrial oils
20. Varied and numerous chemical products

Chicago Area

New products flow from Chicago's chemical industries in greater number and variety than ever before.

ROBERT C. KINTNER
Illinois Institute of Technology
Chicago, Ill.

GRANTED an opportunity, Chicagoans like to boast of their diversified industries and the basic balance of their industrial economy. No one industry dominates the activity of the area. Despite popular opinion to the contrary, meat packing is exceeded in relation to its U. S. total by a half dozen other industries, such as iron and steel, electrical and other machinery, metal working, and chemicals, including petroleum refining.

According to the last census, the process industries of the Chicago metropolitan area were represented by approximately 2,000 plants with output then valued at more than a half billion dollars. There are, for example, over 100 paint and varnish plants alone in the six counties that comprise the Chicago industrial area. To report adequately on even the more important chemical engineering developments is impossible in this brief article. Instead, a few over-all trends will be cited to show how they are reflected in the operations of six or eight typical companies here in the geographical center of American industry.

Three significant trends shows the general pattern of postwar progress: (1) Plants that have proved inadequate to meet today's demands are being modernized and expanded. (2) Improved research facilities—laboratories and pilot plants—are being provided by nearly every important industry of the region. (3) New products are flowing from Chicago's chemical industries in greater number and variety than ever before.

Modernization and Expansion

Abbott Laboratories of North Chicago, now in the sixtieth year of its growth and expansion, is just completing a five-building construction program. This includes efficient structures for the production of penicillin and streptomycin, an expanded administration building, a well-equipped pharmacologic research center, and an addition to the general research laboratories which doubles the facilities of that ten-year-old unit.

At Argo, Corn Products Refining Co. has opened up a new three-story pilot plant building 80 x 226 ft. Current construction includes a unit for the recently developed cold-water-soluble laundry starch, and solvent-extraction equipment with sufficient capacity to handle the corn germ from the company's Argo, Kansas City and Pekin plants; also a new research laboratory. Of considerable importance in the present program of the company is the installation, wherever possible, of control instruments, and the replacement of batch operations with continuous processes.

Corn Products has also under construction a huge plant at Corpus Christi, Tex., with a capacity of 20,000,000 bu. of grain per day.* It is expected that this plant will use grain sorghum as a raw material, although it can operate equally well on corn. Increased capacity for the production of dextrose has been completed at the company's Kansas City plant, and the first large installations of ion-exchange equipment by the wet-milling industry for refining of sirups and sugars are being installed at both the Pekin and Corpus Christi plants.

International Minerals and Chemical Corp. has its home offices in Chicago, and one of its many modern fertilizer plants at Chicago, Ill. Its largest producing centers, of course, are the widely separated mines and plants in Florida, Tennessee, New Mexico, California, and Ohio. Additional new construction in the Midwest includes a 100-ton contact sulphuric acid plant at Lockland, Ohio, and a fertilizer mixing plant at Somerset, Ky.

The main building of the G. D. Searle & Co., pharmaceutical manufacturers, formerly contained all manufacturing, research and administrative operations. Six new buildings, completed within the last year, allow the various functions to be housed in units designed for their specialized uses.

Construction by Swift & Co. of a new industrial oil processing plant at Hammond, Ind., adds new sources of glycerides and fatty acids to the company's present capacity. The new plant combines and coordinates solvent extraction, solvent fractionation and fat splitting.

While the postwar program of ex-

*For details on this unique project, see pp. 99-101 of this issue. *Editor.*

pansion of the Victor Chemical Works had been highlighted by new plant construction near Tarpon Springs, Fla., and at Morrisville, Pa., almost equally significant modernization and mechanization has been quietly going ahead at the company's Chicago Heights location.

New antibiotics are being screened at Abbott Laboratories for possible usefulness. Extensive plans are being laid for the study of the application of radioactivity to therapeutic and diagnostic agents working in cooperation with the United States Atomic Energy Commission.

Armour & Co. has developed, during the past year, an organization for the preparation and distribution of biochemicals of animal origin in order to facilitate biochemical research on some of these interesting molecules which make up living tissue. Currently available are a long series of crystallized proteins.

The new corn products research laboratory at Argo will provide facilities for at least 200 technical workers, as well as the administrative personnel of the chemical division.

In keeping with the increasing complexity of petroleum refining and the rising interest in petrochemicals, Indiana Standard is substantially expanding its research forces. The recently dedicated Whiting Research Laboratory is one of the largest in the country and houses probably the largest group of industrial scientists in the Midwest. The processing of high-sulphur crudes to make suitable feedstocks for the catalytic cracking units gives rise to a substantial number of new sulphur-containing byproducts.

Witco Chemical Co. has concentrated recent research on the unit operations of mixing, pumping and handling of heavy-consistency mastics consisting of asphalt, solvents and fillers.

New Products in Profusion

From these new research facilities and modern plants have come hundreds of new postwar products. Abbott has taken the lead in the introduction of new synthetic drugs and pharmaceuticals. Armour has introduced a number of surface-active agents. Among these are the "Arquads" which are quaternary ammonium salts containing one long aliphatic chain residue. They are useful as germicides and cationic detergents. Large-scale processes have been developed for the production of symmetrical secondary amines containing two long chains having 12 to 18 carbon atoms. Corresponding oil-soluble quaternary ammonium salts will be available in the future as a result of Armour research.

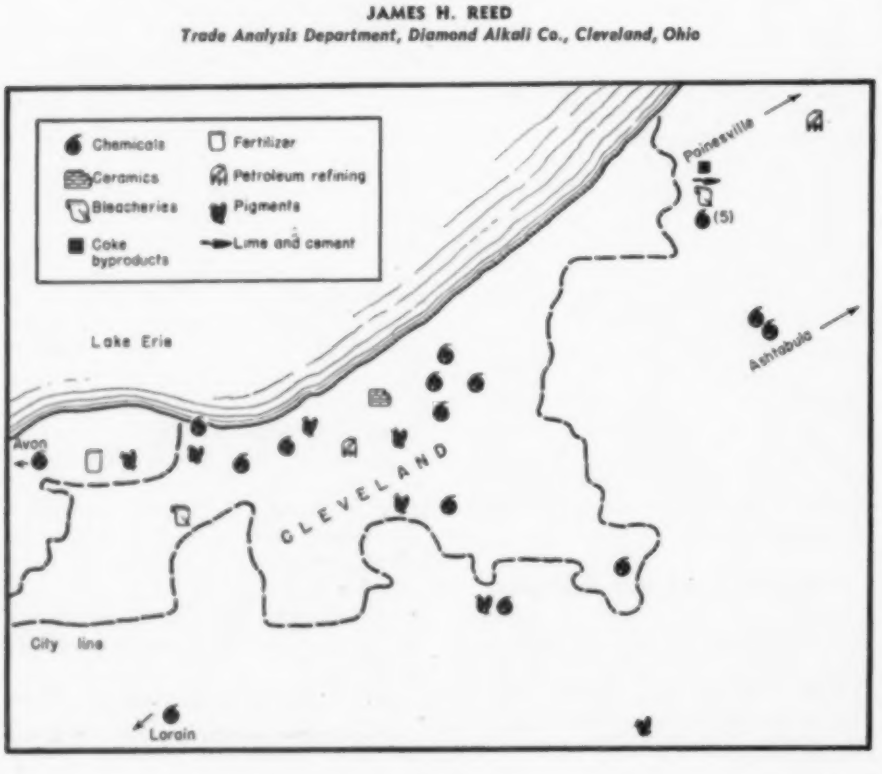
Searle's new products are based on an entirely new principle of suppository preparation combining combinations of waxes of different melting points with medicinal preparations in special molding presses utilizing many features developed in recent work with plastics. Swift researchers are proud of a new all-purpose shortening, made from lard, which does not require refrigeration.

In acknowledging credit to those companies that have cooperated in this brief survey, the writer wishes to express his own regret that time and space were not available for more than a mere sampling of Chicago's chemical progress.

Cleveland Area

Rising trend in postwar requirements force expansion in manufacture and processing of chemicals.

JAMES H. REED
Trade Analysis Department, Diamond Alkali Co., Cleveland, Ohio



ALTHOUGH the accelerated impetus presented by urgent military demands during the war period to step-up chemical output quickly passed as various plants within the area returned to peacetime operation, manufacture and processing of chemicals here has climbed slowly but surely to meet expanded postwar requirements.

Long-time "big name" chemical and related operations in greater Cleveland comprise an imposing list. In the top bracket are such "blue chips" as DuPont's Grasselli Chemicals Department, General Chemical, Harshaw Chemical, McGean Chemical, Standard Oil of Ohio, Glidden, Sherwin-Williams, Ferro Enamel, Industrial Rayon. Others include Lubrizol, Ohio Chemical, American Agricultural Chemical. Among the newcomers are B. F. Goodrich and Goodrich Chemical. Diamond Alkali recently moved its headquarters here from Pittsburgh.

The B. F. Godrich Co.'s recently-opened multi-million dollar research center near Brecksville gives the area science's latest, most complete industrial workshop. The gigantic project comprises six buildings on a 261-acre site, where some 225 scientists and technicians are intensively exploring rubber, plastics, chemicals and other fields in the search for something new and better.

B. F. Goodrich Chemical Co., for-

merly the chemical division of the B. F. Goodrich Co., established headquarters in Cleveland, in 1944. Since then, company functions here have been expanded to include both technical and manufacturing facilities.

In early 1948 construction was begun on the general chemicals plant at Avon Lake. With cost estimated at $3,000,000, this new unit will produce chemicals now in the developmental stage and others which have recently been announced.

One of the principal works of the Grasselli Chemicals Department of the Du Pont company is located in Cleveland. Over the past 12 months, it averaged about 700 employees. It manufactures acids, heavy chemicals, insecticides, and fungicides. Among the best known products made at Cleveland are 2,4-D weed killers and G-942 tanning agent for light leathers.

At Cleveland Grasselli also has a laboratory and semi-works. During the war period Grasselli chemists and engineers at Cleveland developed a process for the commercial manufacture of the well known insecticide, DDT. Another product which has been developed at the Cleveland laboratory is Ludox colloidal silica, for application to such products as textiles, rubber, asbestos, waxes and adhesives.

Cleveland, a cradle of the oil industry continues to keep pace with petroleum progress. The Standard Oil Co. of Ohio operates two refineries here. Having spent $100,000,000 since 1943 in developing its crude oil production, Sohio plans to pour an additional $100,000,000 this year and the next two into further enlargement and improvement of its production and refining facilities. Ohio Standard's Cleveland operations are scheduled to get an appreciable slice of this sum.

From its inception in 1892, the Harshaw Chemical Co. has shown a continuous growth, so that today annual sales hover around the $35,000,000 mark. Its Cleveland and Elyria plants make a myriad of different chemicals having a wide industrial application range.

The Ohio Chemical & Mfg. Co. (acquired in 1939 by Air Reduction Co., Inc.), is one of the largest U. S. producers of anesthetic and therapeutic gases for medical use and has its principal gas-making plant here. Products include nitrous oxide, ethylene, cyclopropane, oxygen, hydrogen, mixtures of oxygen and carbon dioxide, and oxygen-helium mixtures.

Strong Cobb & Co., Inc., pharmaceutical manufacturers in Cleveland since 1833, operates a streamlined production plant incorporating all the latest type tablet machines, coating pans, fractionating towers, and mixers.

The Brush Beryllium Co. manufactures beryllium oxide, beryillum metal, beryillum copper and other beryllium alloys in its plant at Lorain. A sulphuric acid extraction process is used to produce beryllium sulphate from beryl, which is the only Be mineral available in commercial quantities. The sulphate is converted to oxide by heating. Beryllium oxide is mainly used as a refractory and as a constituent in fluorescent lamp phosphors.

Remarkably rapid expansion in business volume of Ferro Enamel Corp. during recent years has elevated this company to a prominent place under the Cleveland chemical sun. Consolidated sales of the firm and its domestic and foreign subsidiaries totaled $27,744,498 in 1947 against $5,055 967 in 1940. Ferro recently completed an extensive expansion-modernization program in its Cleveland plant, making frit capacity here approximately two-thirds higher than it was prewar. Similarly, production facilities for making color oxides for ceramic applications, and colors for glass and plastics have been enlarged.

Through its Liquid Plastics Division, Ferro manufactures and markets Vedoc organic coatings. And Ferro Chemical, a subsidiary with a plant at nearby Bedford, produces metallic soaps (driers) for the paint and varnish industries, and merchandises industrial chemicals. Combined sales in these two fields were approximately $2,000,000 last year.

World's Paint Capital

Cleveland's fame as the "paint capital of the world" is universally acknowledged. Sherwin-Williams, Glidden, Arco, Patterson-Sargent, Ferbert Schorndorfer Co. (division of American-Marietta Co.), Forbes Finishes Division—Pittsburgh Plate Glass Co., and scores of others are headquartered in Cleveland and have major production operations here.

The Sherwin-Williams Co., world's largest producer has expanded facilities in recent years. Manufacturing improvements include installation of new ball mills, roller mills, and three new 1,000-gal. varnish kettles which materially increase plant capacity. The company has just placed in operation here a new $750,000 solvent extraction plant, which will make the company one of the world's major producers of castor oil. The plant employs a company-developed process that now makes it possible, for the first time, to extract oil by a single-step process.

Paint producer, chemical manufacturer, food packer—The Glidden Co. has become all three in one within the span of 31 years. Organized in Cleveland in 1917 with the purchase of the makers of Japalac, first pigmented varnish ever manufactured, Glidden has branched out widely. Its main paint and varnish plant still is here, but it operates 32 factories elsewhere throughout the nation which manufacture a diversified line of products ranging all the way from type metal to margarine. Among others, these include protective and decorative coatings, chemicals and pigments, naval stores, powdered metals, soybean products, and vegetable oils.

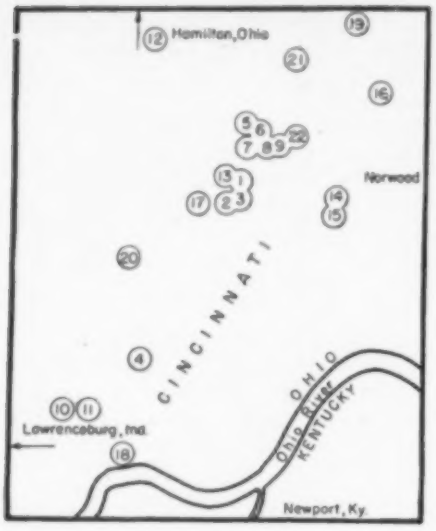
Since the end of the war, The Arco Co., another pioneer paint producer, has spent over $750,000 in improving its facilities here. These include a new lacquer-making unit just put into full-scale production, modernization of plant, and installation of additional processing equipment.

Industrial Rayon Corp.'s Cleveland plant, one of the country's oldest, is devoted entirely to production of tire cord and fabrics marketed under the trade name of Tryon. All this production is by the continuous process method developed here and introduced commercially by the company in 1938 at its Painesville plant. Expansion of the plant during the war and since has more than doubled its capacity.

Activity in the field of industrial gases is highlighted by the operations chiefly of three companies: The Linde Air Products Co., (unit of Union Carbide & Carbon Corp.), Air Reduction Sales Co., and The Burdett Oxygen Co. of Cleveland, Inc. All three produce oxygen and acetylene locally for cutting, welding and flame-treating of metals; also, other gases for other applications. The first two concerns are also working closely at present with a number of steel mills in the perfection and use of "tonnage" oxygen; Burdett plans to enter the field shortly.

The Lubrizol Corp. has been manufacturing addition agents for petroleum lubricants at its plant in Wickliffe for about 15 years. Its products are used for improving service properties of crankcase lubricants, transmission and rear axle lubricants, cutting oils, etc. Its facilities have been enlarged repeatedly as research, performance-testing and manufacturing needs have required.

Still other concerns active on the local scene include American Agricultural Chemical Co. (fertilizers), Harris-Seybold Co. (lithographic chemicals), and The Parker Appliance Co. (rubber compounds and plastics).



1. Procter and Gamble — Soaps, oils
2. Drackett Chemical Co.—Chemicals
3. National Cylinder Gas—Gases
4. Andrew Jergens Co.—Soap, cosmetics
5. Harkness-Cowing Co.—Soap, red oil
6. Werks Soap Co.—Soap
7. American Agricultural Chem. Co.—Fertilizers
—Fertilizers
8. Armour Fertilizer Works—Fertilizers
9. Virginia-Carolina Chem. Co.—Fertilizers
10. Schenley Labs., Inc.—Chemicals
11. Jos. E. Seagrams and Sons—Distilled liquors
12. Champion Coated Paper—Pulp, paper
13. Emery Industries—Candles, stearic acid
14. Cincinnati Chem. Co. — Chemicals
15. Interchemical Corp. — Dyes, printing ink
16. Hilton-Davis Co.—Chemicals
17. Formica Insulation Co.—Plastics
18. Liquid Carbonic Inc.—Gases
19. Wm. S. Merrell Co. — Pharmaceuticals
20. Oil-Kraft Inc.—Lubricants
21. National Distillery—Distilled liquors
22. Standard Silicate Co.—Silicates

Cincinnati Area

Cincinnati increases facilities for producing chemicals, drugs, soap, insecticides and fertilizer.

R. C. STILLMAN
Cincinnati, Ohio

CHEMICAL industries in the greater Cincinnati area are located mainly in the Mill Creek industrial section. This follows the course of the Mill Creek northward from the Ohio River toward Hamilton, Ohio—a distance of about twenty miles. Many of these industries had their beginning on or near Front and Water Streets, almost on the banks of the Ohio. Need for expansion and the yearly menance of floods in the lowlands gradually forced expansion away from the river bottoms northward along the smallest of the many Cincinnati waterways.

Manufacture of paints, varnishes, lacquers, colors and pigments rates high among local industries. One of the newest in this field is The Aluminum Industries, Inc., producers of Permite ready-mixed aluminum paints. Dutch Brand house paint, Por-Cel-O-Tint gloss wall finish, Dubl-Lift, Stay-Bright, and Presto-Namel, manufactured by Perry and Derrick likewise are popular Cincinnati products, as are those of the American Lacquer Co., Interchemical Corp., R. A. Becker & Co., Black Diamond Paint & Varnish Works, Foy Paint Co., Permanent Pigment and the Hilton-Davis Co.

The Drackett Co. recently built a new plant for processing soybeans north of Cincinnati proper. Included in the operations is a solvent plant for extraction of soybean oil. Procter & Gamble Co., at Ivorydale, has for years carried on extensive refining of vegetable oils for food products in addition to the conversion of copra into coconut oil.

Drugs, toilet preparations, and insecticides form another important manufacturing group in the greater Cincinnati area. Newest of these industries is a direct result of World War II. Production of penicillin and other antibiotics was started by the Schenley Laboratories, Inc., as a war effort. Continuance of the manufacture of antibiotics is a major contribution to the chemical industry in the Lawrenceburg factory of that company.

Among recent industrial developments in the area is the manufacture of DDT by the Cincinnati Chemical Works. This company is also a leader in the preparation of dyestuffs and fine chemicals.

Engaged in the manufacture of soap, glycerine, fatty acids, and candles are a number of chemical concerns, employing several thousand persons. In this field, much of the newest development has occurred. Procter & Gamble Co. recently built two plants at Ivorydale for the manufacture of fatty alcohols used in their synthetic detergent sodium alkyl sulphate. This synthetic detergent is widely marketed in Dreft, Tide, Drene, and other products. Continuous soap making has been reported. Expansion of equipment for spray drying of soap and synthetic granules is being carried out.

Emery Industries has announced the Emersol process for solvent fractionation of fatty acids. A unit has been built at their Cincinnati plant.

The Andrew Jergens Co. is the second largest soap producer in Cincinnati area. The M. Werk Soap Co., one of the oldest firms in the business, continues active in the manufacture of Tag Soap, Werko, Werx chips and flakes, fatty acid, candles, and glycerine. Other manufacturers in the field are Harkness and Cowing Co., Fischer Industries and Dubois Soap Co.

The American Agricultural Chemical Corp., the Armour Fertilizer Works, the Tennessee Corp. and the Virginia Carolina Chemical Co. have long been active in this territory in manufacturing complete commercial fertilizers.

Two concerns, the Formica Co. and Drackett Chemical Co. are engaged in the manufacture of plastic materials. The Formica Co. produces Formica, a phenol-formaldehyde plastic widely used for gears, wall finishes, table tops, counters, doors, etc. The Drackett Co. is interested in a new line of plastics from soybean protein.

In the field of heavy chemicals, the Graselli Co. produces battery acids, sulphuric acid, nitric acid, and salt cake, while the General Phosphorus Co. produces sequisulphide of phosphorus, amorphous (red) phosphorus, and phosphorus penta sulphide. The Schenley Corp., Jos. E. Seagrams and Sons, and the National Distillers Products Corp. are large producers of grain alcohol. The Standard Silicate Co. produces large quantities of silicate of soda. The Champion Paper and Fiber Co. located in Hamilton is one of the country's large producer of coated paper. Oil Kraft, Inc. manufactures petroleum products, including petroleum jelly and white oil.

Fries and Fries, Alex Fries and Bro., Inc., and the Berghausen Chemical Co., which produce flavors and cordials for food and drug manufacturers, are integral parts of Cincinnati's industry. Others, such as the Ecker Chemical Labs, which is pioneering in the field of catalytic dehydrogenation may some day build to a major industry in the area.

The writer wishes to thank the Industrial Division of the Cincinnati Chamber of Commerce for its aid in obtaining some of the information here presented.

Minneapolis-St. Paul Area

Research is paving the way for wide expansion in the drying-oil industry of Minnesota.

LLOYD H. REYERSON
School of Chemistry
University of Minnesota
Minneapolis, Minn.

THE FALLS of St. Anthony brought milling to the Twin Cities while the Mississippi and St. Croix rivers carried the virgin pine of the great north woods to the lumber mills of the area. Today the cutting of trees for timber is a minor industry of the area but the pulp and paper mills of the north have expanded and are flourishing. Research has taught these mills that many woods including second growth timber can be successfully converted to good paper by a variety of chemical processes.

Economic factors have also moved the center of the grain milling industry from the Twin Cities but here the principal milling companies have established their research laboratories and from these laboratories have come many revolutionary developments in food processing. Discoveries in these laboratories have resulted in great diversification of the milling industry. For example, General Mills at present is fractionating low grade flour into starch and gluten. This has led to the development of a line of modified starches. The gluten is hydrolyzed and many derivatives of glutamic acid are being marketed. Recently this company built a large plant at Kankakee, Ill., where vegetable, marine and animal oils of all kinds, including tall oil from the forest, will be hydrolyzed to produce a number of fatty acids. This development from the research laboratories in Minneapolis contemplates hydrogenating the unsaturated acids, if need be, and then reconstituting specific tri-glycerides, pentaerythritol esters and the like. This same research organization has been studying the fundamental chemistry of the thermal polymerization of drying oils, the synthesis of new protective coatings and the production of a new series of organic chemicals.

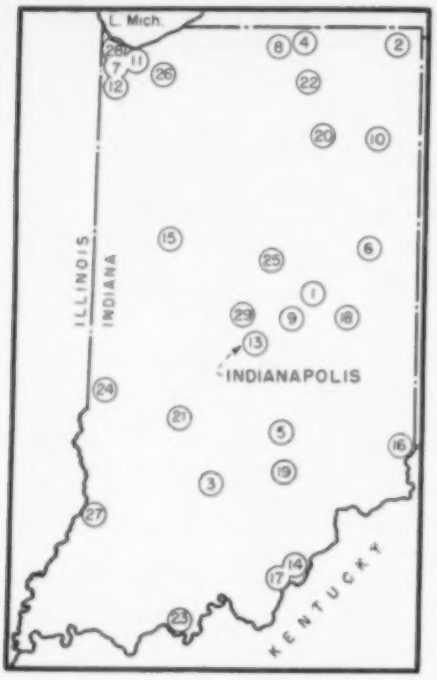
Just as the milling industry is entering new fields of endeavor as a result of research so too is the drying oil industry of the Twin Cities undergoing a rapid and far reaching change. As an example, the Archer-Daniels-Midland Co. recently consolidated its research activities in a new well designed research laboratory. No longer are investigations limited to the behavior of linseed oil but all sorts of drying oils are being studied in a fundamental way. Already the linseed oil industry is feeling the impact of the researches in progress, so that it will soon be a drying oil industry no longer entirely dependent upon the flaxseed which built the original plants.

Established in 1902 to mine and market corundum the Minnesota Mining and Manufacturing Co. of St. Paul credits scientific research for much of its rapid and consistent growth. Its first product of research activities was Wetordry sandpaper, the world's first waterproof sandpaper. This was followed by the Scotch pressure sensitive masking tape which was first of more than 140 Scotch brand tapes which 3M research has developed for home and industrial use.

Minnesota has long been known for the iron ore coming from its iron ranges. As the high grade ore is used up research has made possible the benificiation of the lower grades which exist in much larger tonnages. The Mines Experiment Station of the University of Minnesota has been the leader in this work and in addition it has worked out a method for producing high grade iron powder from certain iron carbonate ores. This has resulted in the building of a powdered iron plant on the iron range. This operation is expected to begin during the present year.

Three institutes at the University of Minnesota are actively engaged in researches that may lead to an expansion of the chemical industry in the area. The Hormel Research Institute with its laboratories at Austin, Minn., is busy studying a number of fundamental problems connected with the meat packing industry. Already some of the discoveries made there are being put into practice by the industry. At the same time the Northwest Research Institute, supported by grants from local interests, has developed a method for the production of alpha cellulose from the second growth timber, aspen. This process is ready for large scale pilot plant study. This institute also has developed through the pilot plant stage several methods for gasifying the low grade fuel, the lignites, of the Dakotas and Montana. During the war the U. S. Bureau of Mines using the process as developed at Minnesota built a large scale plant at Grand Forks and is now operating it as an experimental unit of commercial size. The importance of this work on lignite has resulted in the establishment of a separate lignite station of the Bureau of Mines in North Dakota. Much may be expected from this station in the future, particularly with reference to liquid fuels, fertilizers and chemicals. The Minnesota Institute of Research, supported by legislative funds, has spent much of its effort on the chemical treatment of seed flax straw for the making of linen yarn. A pilot plant is at present producing a high grade linen yarn from such by-product straw. This linen is so good that it is confidently expected that commercial chemical retting of by-product flax straw will be realized in the very near future.

While the chemical industry has been slow to develop in the area, the prospects appear excellent for far greater expansion in the near future. Research is again leading the way.



Indianapolis Area

1. Anderson. *Chemicals:* Philadelphia Quartz Co.
2. Angola. *Chemicals:* Hickory Chemical Labs.
3. Bedford. *Pharmaceuticals:* Midstate Pharmacal Co.
4. Bristol. *Chemicals:* Elk-Sell Chemicals
5. Columbus. *Pharmaceuticals:* H. W. Kinney & Sons
6. Dunkirk. *Pharmaceuticals:* Armstrong Cork Co.
7. East Chicago. *Chemicals:* Carbide & Carbon Chemicals, E. I. du Pont de Nemours & Co.
8. Elkhart. *Pharmaceuticals:* Ames Co.
9. Fortville. *Chemicals:* E. I. du Pont de Nemours & Co.
10. Fort Wayne. *Chemicals:* Hoosier Solvents & Chemicals Corp.
11. Gary. *Chemicals:* Oxi Corp; *Pharmaceuticals:* Apollo Drug Co.
12. Hammond. *Chemicals:* American Chemical Service, Indiana Labs., Stauffer Chemical Co.
13. Indianapolis. *Chemicals:* Alkaloid Corp., American Industrial Chemical Co., Barrett Div., Allied Chemical & Dye Corp., Burns Labs., Char Products Downard Sanitary Specialities Mfg. Co., Hoosier Solvents & Chemicals Corp., Jiffee Chemical Co., Wm. Lynn Chemical Co., Marion Mfg. Corp., Peripad Labs., Reilly Tar & Chemical Corp., Velvet Power Co.; *Pharmaceuticals:* James S. Airhar, Anesthetum Inc., George N. Bell, C. M. Bundy Co., Chemico Labs. Inc., Corn States Serum Co., Dabney Pharmacal Co., Lilly & Co., G. P. McDermott & Co., Modern Drugs Inc., Tannin Products, Tri-State Pharmacal Co.
14. Jeffersonville. *Chemicals:* Philadelphia Quartz Co.; *Alcoholic Beverages:* Distilled Products Co.
15. Lafayette. *Pharmaceuticals:* Lafayette Pharmacal Co.
16. Lawrenceburg. *Alcoholic Beverages:* Jos. E. Seagrams & Sons, Jos. E. Schenley Distilleries (Old Quaker Div.), James Walsh & Co.
17. New Albany. *Chemicals:* Glover M. Birk; Wolfe Co.
18. New Castle. *Pharmaceuticals:* Arnold Labs.
19. Seymour. *Pharmaceuticals:* Central Pharmacal Co.
20. South Whitley. *Pharmaceuticals:* Nutritional Research Assoc.
21. Spencer. *Pharmaceuticals:* World's Products Co.
22. Syracuse. *Chemicals:* Levernier Labs. Corp., Detergent Corp.
23. Tell City. *Alcoholic Beverages:* Park & Tilford Distillers
24. Terre Haute. *Pharmaceuticals:* Commercial Solvents Corp.; *Alcoholic Beverages:* Commercial Solvents Corp., Merchants Distilling Corp.
25. Tipton. *Pharmaceuticals:* Inland Alkaloid Co.
26. Valparaiso. *Pharmaceuticals:* Continental Pharmaceutical Corp., Golden Acres Inc.
27. Vincennes. *Alcoholic Beverages:* W. P. Squibb Distilling
28. Whiting. *Chemicals:* Carbide & Carbon Chemicals Corp.
29. Zionsville. *Pharmaceuticals:* Pitman-Moore Co.

Chemical production in Indiana draws heavily on farm products and petroleum as basic raw materials.

R. NORRIS SHREVE
School of Chemical and Metallurgical Engineering
Purdue University
Lafayette, Indiana

INDIANA is important in the location of chemical plants from a number of viewpoints, among which three are of considerable importance. These are abundance of corn, economic access to large markets and a virile labor supply.

Extensive cornfields have encouraged such carbohydrate processing companies as Commercial Solvents Corp. and American Maize Co. on the one hand, and the whiskey distillers, such as Seagrams and Schenley, on the other hand. Indiana in recent years has become a large grower of soybeans, thus replacing corn to some extent.

Standard Oil Co. of Indiana is currently the largest organization in the state in the chemical process industries. It has always been a progressive organization, having pioneered in the cracking of petroleum a generation ago. It made a very large amount of toluene during World War II, and is now enlarging its efforts to make chemicals from petroleum. To hasten these steps as well as to accelerate its own research programs, the company recently dedicated a series of excellently equipped research laboratories and pilot plant facilities at Whiting.

To illustrate the actual production of chemicals from petroleum raw materials, we have already cited alcohol. Here the making of ethyl alcohol from ethyl hydrogen sulphate is now a very important product of the Carbide and Carbon Chemcials Corp. plant at Whiting. Other alcohols also are being manufactured by the same company, such as isopropyl by the same direct esterification procedure as used for ethyl alcohol.

It is interesting to note that Commercial Solvents Corp. continues to make ethyl alcohol by fermentation of carbohydrates. If properly controlled, fermentation is still a promising procedure for the making of chemicals. Witness the production of riboflavin by Commercial Solvents in competition with strictly chemical synthesis.

But most striking of any fermentation process is that employing carbohydrates plus the proper adjuvants to make such antibiotics as penicillin. In Indiana, the Commercial Solvents Corp. and Eli Lilly have both been outstanding. The new and large Kentucky Avenue plant of Eli Lilly & Co. in Indianapolis exemplifies the adaptation of a large war-built plant to modern fine chemicals. So do the extensive new operations of Charles Pfizer & Co., operators of the Chemical Corps biological plant near Terre Haute.

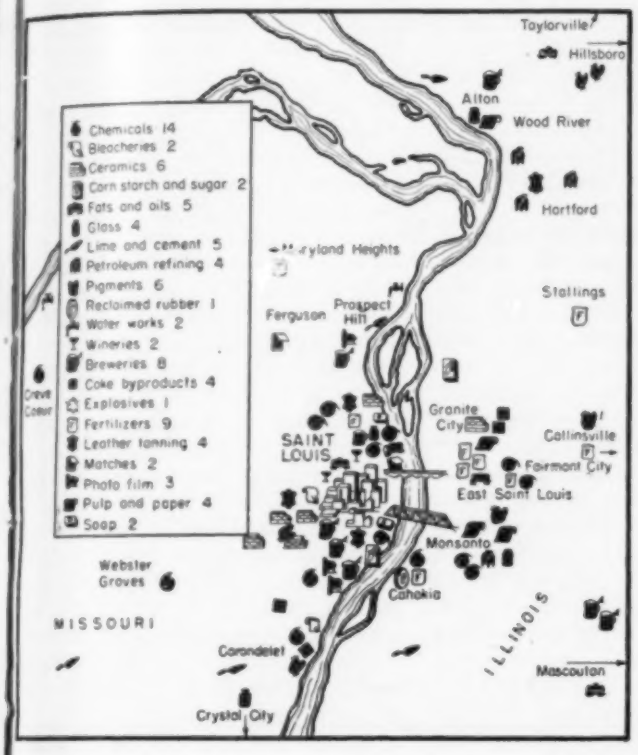
Commercial Solvents has a new plant at Terre Haute for the manufacture of such insecticides as benzene hexachloride. This same company has under construction several new units of its research division at Terre Haute which will more than double its present facilities and provide engineering and pilot plant works.

Reilly Tar & Chemical Co. continues to expand its operations and has now a complete line of the principal constituents of coal tar. Research is under way to enlarge the markets for many of the minor aromatic or heterocyclics and their derivatives. Purdue University is cooperating in the study of the methyl naphthalenes.

Manufacture of surface protective and decorative finishes has become

a flourishing industry in Indiana. Lilly Varnish Co. has recently enlarged its facilities and established research fellowships at Purdue University to develop new and improved products.

Soap making and its related hydrogenation of fatty oils continues to show a healthy growth. The Lever Bros. plant in the northern part of the state is an important factor in this field.



St. Louis Area

St. Louis chemical industries will spend 50 to 100 million dollars in modernizing and enlarging facilities.

RICHARD M. LAWRENCE
Development Department
Monsanto Chemical Co.
St. Louis, Mo.

Chemical
Aluminum Ore Co.
American Zinc, Lead & Smelting Co. (2 plants)
Dykem Co.
General Chemical Co.
Koppers Co.
Mallinckrodt Chemical Works
Monsanto Chemical Co. (3 plants)
Philadelphia Quartz Co.
Tretolite Co.
Warner-Jenkinson Mfg. Co.

Bleacheries
Comey Process Co.
Lowell Bleachery, Inc.

Breweries
Anheuser-Busch, Inc.
Falstaff Brewing Co.
Gast Brewery, Inc.
Griesedieck Brothers Brewery Co.
Griesedieck Western, Belleville
Hyde Park Breweries Assn.
Mound City Brewing Co.
Star-Peerless Brewery Co.

Ceramics
Blackmer & Post Pipe Co.
Evens & Howard Sewer Pipe Co.
General Refractories Co.
Laclede-Christy Co.
Walsh Refractories Corp.
Western Fire Brick Co.

Coke By-products & Tar

Distillers
Koppers Co.
Laclede Gas Co.
Missouri-Illinois Furnaces, Inc.
Reilly Tar & Chemical Co.

Corn Wet Milling
Anheuser-Busch, Inc.
Union Starch & Refining Co.

Explosives
Olin Industries

Fertilizers
American Agricultural Chemical Co.
Armour & Co.
Darling & Co.
Illinois Farm Supply Co.
Lange Brothers
Missouri Farm Assn.
Smith-Rowland Co.
Swift & Co.
Virginia-Carolina Chemical Corp.

Glass
Mississippi Glass Co.
Obear Nester Glass Co.
Owens-Illinois Glass Co.
Pittsburgh Plate Glass Co.

Leather Tanning
California Tanning Co.
Fouke Fur Co.
Hermann Oak Leather Co.
International Shoe Co.

Lime & Cement
Alpha Portland Cement Co.
Columbia Quarries Co.
Glen Park Glencoe Lime Co.
Mississippi Lime Co.
Missouri-Portland Cement Co.

Matches
Cupples Co.
Universal Match Corp.

Petroleum Refining
Shell Oil Co.
Socony-Vacuum Oil Co.
Standard Oil Co. (Ind.)
Wood River Oil & Refining Co.

Photo Film
Buck X-Ograph Co.
Cramer Dry Plate Co.
Hammer Dry Plate Co.

Pigments
American Zinc Lead & Smelting Co.
The Chemical & Pigment Co. (Glidden)
Eagle-Picher Co.
George S. Mepham Corp. (C. K. Williams)
National Lead Co.
National Lead Co. (Titanium Div.)

Pulp & Paper
Alton Box Board Co.
American Asphalt
Celotex Corp.
Certainteed Products Corp.

Reclaimed Rubber
Midwest Rubber Reclaiming Co.

Soap
Lever Brothers
Procter & Gamble

Vegetable Oil Refining
The Allied Mills
The Blanton Co.
Hunter Packing Co.
Laclede Packing Co.

Water Works
Chain of Rocks
Howard Bend

Wineries
American Wine Co.
John Bardenheier Wine & Liquor Co.

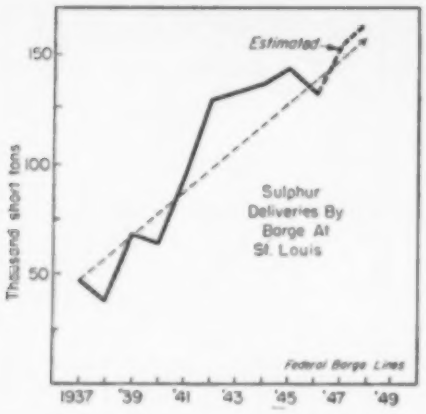
Map and tabulation compiled by John D. Kerr and Roland C. Marquart, Industrial Bureau, St. Louis Chamber of Commerce, 1948.

ST. LOUIS, at the crossroads of the nation, is a great workshop, market, assembly point, and distribution center. From strong roots in its own raw materials like limestone, lead ores, and clays, St. Louis industry branches out into highly fabricated products such as shoes and stoves, drugs and airplanes.

With immense coal fields at its door, and served by large petroleum and natural gas pipelines, the fuel resources of St. Louis are another asset. Electric power capacity, now one-million kw., will be doubled within a decade. Water supplies are unlimited.

On the map are shown the chemical plants of St. Louis, and the chemical process plants which are their customers—and suppliers. These include box board and bottle plants, a tannery, and a brewery, which rank among the largest in the world. Sulphuric acid and other heavy chemicals find large local markets. Hundreds of intermediates, drugs, reagents, and other fine chemicals made in St. Louis, play an important part, also, in the national and world picture.

Epitomizing the basic advantages of St. Louis industries, the Missouri Portland Cement Co., at the gates of the city, on top of its shale quarry, and a few miles from its own limestone deposits, ships over the terminal railway, and its own dock on the river. The fuel, pulverized coal, is brought a short distance from southern Illinois mines.



This company is investing several million dollars to virtually rebuild and modernize its plant. Their two new cement kilns, 450 ft. long, among the largest pieces of moving equipment in all industry, will soon be effecting a 25 percent fuel economy over the 300-ft. units they are replacing.

Firm in their faith in the city's future, St. Louis chemical industries are pushing in impressive stacks of blue chips. Development-minded managements have recently spent, or will soon spend, $50 to $100 million in modernizing and enlarging their facilities. Spearheading the expansion are developments in synthetic detergents, petrochemicals, and solvent extraction of vegetable oils.

Aluminum Ore Co., which produces immense quantities of alumina, now turns out over 50 products for the chemical trade. They operate fluorspar mines at Rosiclare, Ill., and, to strengthen their position as the world's largest producers of fluorides, they are building additional capacity for sodium fluoride and bifluoride.

The Titanium Pigment Division of National Lead Co. recently completed a two-year construction program, which increased capacity and doubled employment at its Carondelet plant.

Mallinckrodt has erected new buildings to house half a dozen projects to meet the increased demands for reagents, analytical, pharmaceutical and photographic chemicals. A major project involves expansion of facilities operated for the Atomic Energy Commission.

Bulking large in the area's chemical and processing complex are the three plants of Monsanto Chemical Co., which are sharing in the company's $100 million, two-year expansion outlay. A Santomerse plant, and a large and complex plant to produce caffeine by the new process announced in 1946, were put into operation during the year. A complete engine and chemical laboratory for testing and researching oil additives also was completed.

Chlorine capacity at the Monsanto, Ill., plant has been more than doubled by installations of new type Hooker S cells. The CWS plant, which was operated for the government during the war, has been leased and converted to the manufacture of oil additives, DDT, 2,4-D, and Niphos-T.

To service these and other additions, the boiler plants on each side of the river are installing big additional units of advanced design. Monsanto's headquarters in St. Louis have been greatly expanded by the addition of a nine-story, air-conditioned and semi-windowless office building.

Monsanto's St. Louis personnel in plants, laboratories, and offices now total in excess of 5,300, a postwar gain of 40 percent. General Chemical Co., which produces sulphuric acid and alums at East St. Louis, is now employing as raw material for the latter, a high-alumina clay from their own properties at Owensville, Mo.

A major expansion and modernization program is being carried out at the Socony-Vacuum refinery at Monsanto, Ill. A 20-inch pipeline, the largest installed since the war, brings crude oil 650 mi. from Corsicana, Tex. Storage capacity is being increased by one-million barrels. The refinery's 21,000 bbl. per day capacity is being increased 50 percent, and the HF alkylation unit is being rehabilitated to produce components for aviation gasoline and high-test motor fuel. Doctor treating units are being replaced with modern Solutizer treating units using Koch Kaskade towers.

Unique Sphere

Shell Oil has completed about half its $18 million expansion program at Wood River, which will raise capacity 45 percent above the prewar level of 80,000 bbl. per day. A new crude oil line from Cushing, Okla. (jointly owned with Texas Co.), will be placed in operation in 1949, by which time crude oil storage capacity will have been increased by one-million barrels. Other expansions and extensions include the power plant, marine terminal, and a finished-product pipeline to St. Louis. Among new process units is the much-talked-of vacuum flash unit of unique spherical design. At its new plant on adjacent property, Shell Chemical Corp. has been producing intermediates for synthetic detergents since last February. This may be the initial unit of a complete synthetic detergent plant, and a large petrochemical development.

Standard Oil Co. (Indiana) has increased the crude oil capacity of its Wood River refinery by 37 percent, to 42,500 bbl. per day, and plans chemical facilities there in the near future. One project is the production of a motor oil additive and another is a synthetic detergent plant.

The Wood River Oil & Refining Co., established in 1941, is now completing a $2 million expansion program. New equipment includes a Perco catalytic de-sulphurization unit.

Exemplifying recent advances in oil and fat technology is the highly modern solvent extraction plant of Allied Mills, with a daily capacity of 100 tons of soybeans. Hunter Packing Co. soon will start up their modern tallow plant, which renders out under vacuum in steam-jacketed cookers that also serve as extractors, using heptane as solvent. This streamlined plant includes impressive safety features, and provides efficient solvent recovery by manifolding all vents into a final condenser, followed by carbon adsorption. Laclede Packing Co. installed a similar plant a few years ago.

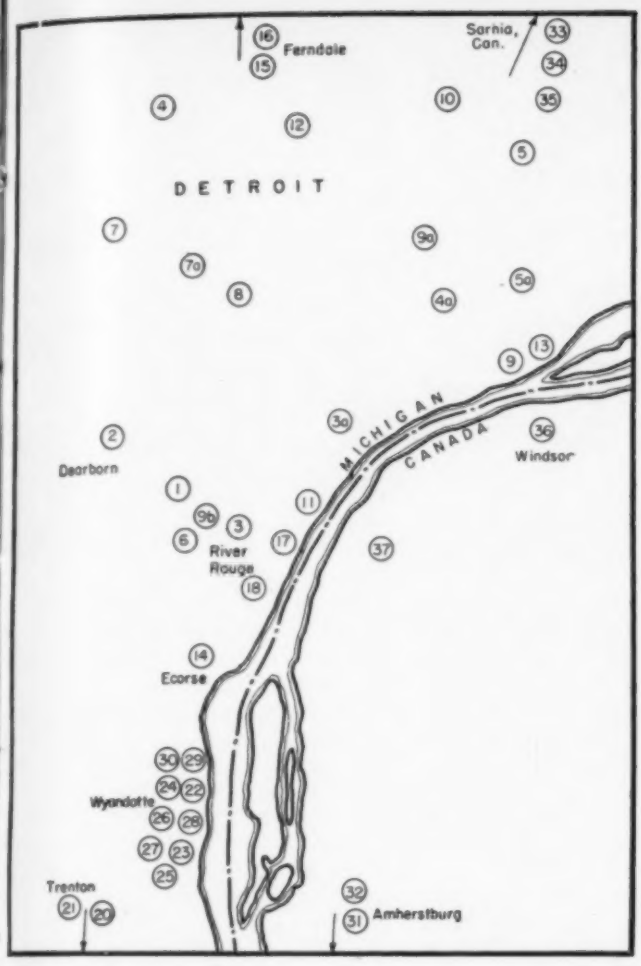
Buckeye Cotton Oil Co. (P&G) has established a $750,000 soybean and cotton oil plant in the vicinity of Sikeston, Mo. Blanton Co., a pioneer in oleomargarine, and now also a leading manufacturer of salad dressings and cooking oils, is installing a hydrogenation unit to process their vegetable oil requirements.

Lever Brothers has purchased a large tract in St. Louis, and announced a soap and synthetic detergents project representing an initial investment of $10 million, to be expanded to $40 million within about 10 years.

At Louisiana, Mo., the Bureau of Mines is installing two plants for liquid fuel process development. The $7 million Bergius (hydrogenation) plant, to start operations soon, will produce about 200 bbl. of gasoline per day from 100 to 200 tons of coal. The second, a $4.5 million Fischer-Tropsch plant, which will go into operation in 1949, will produce automotive gasoline and diesel fuel from coal.

At Washintgon University the first unit in an expansion program for the School of Engineering is under way. A $500,000 structure, it will house the Sever Institute of Technology. The University's Research Foundation is carrying on projects in such fields as guided missiles, new kinds of yeast, drying of fine chemicals, and atomic energy. A new "hot lab" was completed this year.

Farm co-ops are expanding their fertilizer manufacturing operations. Illinois Farm Supply Co. is completing a superphosphate and mixing plant at Collinsville, and Missouri Farm Association is building a similar plant in St. Louis County.



1	Ford Motor Co.	Glass, fertilizers, tars, distillates
2	Klem Chemicals, Inc.	Cleaners
3	American Agriculture Chem. Co.	Fertilizers
3a	Apex Chemical Mfg. Corp.	Cleaners
4	Aurora Gasoline Co.	Petroleum refinery
4a	Etsol Synthetic Products	Cleaners
5	Gelatin Products Div. of R. P. Scherer Corp.	Gelatin capsules
5a	Industrial Chemical Prods. Co.	Cleaners
6	International Salt Co.	Salt mining
7	Nelson Chemicals Corp.	Cleaners and bleach
7a	Northwest Chemical Co.	Cleaners
8	Park Chemical Co.	Cleaners and bleach
9	Parke Davis & Co.	Pharmaceuticals
9a	Parker Rust Proof Co.	Cleaners
9b	Patterson Labs.	Bleach
10	Roman Cleanser Co.	Cleaners and bleach
11	Solvay Process Co.	Heavy chemicals; alkalis
12	Solventol Chem. Prods., Inc.	Cleaners
13	U. S. Rubber Co.	Rubber
14	E. I. du Pont de Nemours & Co.	Acids
15	Ethyl Corp.	Laboratories
16	Reichhold Chemicals, Inc.	Plastics, plasticizers
17	Barrett Div., Allied Chemical & Dye Corp.	Tars, distillates
18	General Chemical Co.	Acids
20	Monsanto Chemical Co.	Heavy chemicals; phosphates
21	Socony-Vacuum Oil Co. (White Star Div.)	Petroleum refinery
22	E. I. du Pont de Nemours & Co.	Trichlorethylene
23	Halowax Products Div.	Chlorinated waxes
24	National Carbide Corp.	Acetylene
25	Pennsylvania Salt Mfg. Co.	Heavy chemicals; alkalies
26	Werner G. Smith Co.	Hydrogenated fish oils
27	Sharples Chemicals, Inc.	Organic chemicals
28	Wyandotte Chemicals Corp.	Heavy chemicals; alkalis, chlorine
29	Wyandotte Chemicals Corp.	Heavy Chemicals; alkalis, chlorine
30	Wyandotte Chemicals Corp.	Cleaning materials
31	Brunner Mond	Heavy chemicals; alkalis
32	Calvert Distillers	Whiskey, ethyl alcohol, fusel oil
33	Dow Chemical Co.	Glycols and plastics
34	Imperial Oil, Ltd.	Petroleum refinery
35	Polymer Corp.	Synthetic rubber
36	Hiram Walker & Sons, Inc.	Whiskey, ethyl alcohol, fusel oil
37	Canadian Industries, Ltd.	Chlorine

Out State Michigan (Not shown on map)

Dow Chemical Co., Midland	Heavy and fine chemicals
Huron Milling Co., Harbor Beach	Wheat products, monosodium glutamate, amino compounds
Michigan Chemical Corporation, St. Louis	Chemicals' bromine, magnesium oxide, salt

Detroit Area

Automotive industry has been prime factor in chemical development of the area.

MELVIN E. CLARK
Sales Manager for Heavy Alkalis, Wyandotte Chemicals Corp., Wyandotte, Mich.

CHEMICAL industry in the Detroit area owes its existence largely to three factors: extensive underlying deposits of rock salt, strategic location on the Great Lakes waterway transportation system, and the presence of the gigantic automotive industry. These factors provide raw materials and markets, economic cornerstones for any industry.

Industrial cleaners and alkaline degreasing compounds are made by a host of plants in Detroit, largest of which is Wyandotte Chemicals Corp., West Plant, formerly the J. B. Ford Co. Plating chemicals and water softening compounds are also made by some of these companies.

A prewar development which reached peak volume during the war was chlorinated degreasing compounds. Largest producer in this field is Du Pont, Electrochemicals Department. In 1942 this company expanded by building a plant at Wyandotte to supply the Detroit market. Chlorine for this plant is supplied largely by Wyandotte Chemicals—thus forging another link between the old chemical industry and the new automotive industry.

At Delray, Solvay Process Division of Allied Chemical & Dye Corp., operates a soda ash and lime-soda caustic plant which is being expanded. It is supplied with coke, ammonia and coke-oven gas by Semet-Solvay. By-products of the coke ovens, together with other purchased tars, are refined by Barrett Division also a unit of Allied Chemical.

Sulphuric acid plants of General Chemical and Du Pont, Grasselli Department, supply pickling acid for nearby steel mills at Ecorse and for other uses in the area.

At Wyandotte, Wyandotte Chemicals Corp. operates three plants producing alkalis, cleaning materials and organic chemicals. In addition to supplying Du Pont's nearby trichloroethylene plant with chlorine, Wyandotte supplies soda ash and hydrogen to Penn Salt, chlorine to Halowax Division of Union Carbide and Carbon Corp., alkalis to Monsanto at Trenton. National Carbide Corp. produces acetylene from calcium carbide for Du Pont. Sharples Chemicals Corp. produces organic solvents and fine chemicals for a variety of purposes. Many of their products go directly or indirectly into automotive industry use. Sharples purchases chlorine, ammonia and other raw materials from Penn Salt's plant across the road. Also at Wyandotte, Werner G. Smith, a subsidiary of Archer-Daniels-Midland, makes hydrogenated oils using Penn Salt hydrogen.

Elsewhere in the area are chemical plants supplying basic human needs,

such as the bleach plants of Roman Cleanser and Nelson Chemicals Corp., Parke, Davis & Co., one of the largest pharmaceutical manufacturers in the United States, and others. Frederick Stearns Mfg. Co., oldest pharmaceutical manufacturing plant in Detroit, was sold to Sterling Drug Co. in 1944 and was moved recently to Myerstown, Pa.

Outside the area, but contributing substantially to the Michigan chemical output are various other operations. Largest of these is Dow Chemical Co.'s huge plant at Midland. This plant was built to produce bromine from saline brines but soon branched out to chlorine, caustic soda and organic chemicals of various kinds. Dow made the first commercially successful magnesium at Midland and later expanded at other plants.

At St. Louis, Mich., is the operation of the Michigan Chemical Co., producers of bromine, calcium and magnesium chloride, DDT and other organic chemicals.

Production of mono-sodium glutamate by the Huron Milling Co. at Harbor Beach has been a fairly recent chemical development in Michigan. Glutamic acid occurs abundantly in most proteins but wheat protein is a particularly rich source. Capitalizing on its favorable position in the wheat protein and starch business, Huron Milling began commercial production of mono-sodium glutamate in 1934. Since that time the company has repeatedly expanded its operation in this field.

Dow's glycol production at Midland, particularly propylene glycol, has been materially increased to meet the demands of the food, pharmaceutical and cosmetic industries. Industrial demands, too, have increased measurably. Large scale production of the Dowanols, a series of propylene glycol and polypropylene glycol ethers and esters, has been initiated. Recent commercial production of the polyglycols, high molecular weight ethers, has been started in conjunction with the Dowanols. During recent months Dow has made commercially available methionine and tryptophan; as well as the other essential amino acids, lysine, threonine, phenylalanine, leucine, isoleucine and valine, on semi-plant scale.

In the plastics line, Dow's Saran and Styron production is being increased. One of the newer developments is Saran 517 transparent film for food packaging. Dow has shown continued activity in the emulsion and latex phase of the plastics industry, with the introduction of a styrene–butadiene copolymer latex known as Latex 512. It has found prompt acceptance in the paper industry as a valuable adjunct to casein and starch as a binder for clay-coated paper. New Saran latices of the vinylidene chloride copolymer type have been developed, which are used as functional type coatings for a wide variety of materials including cloth, paper and metals.

Expansions

Dow's production facilities have been greatly increased for 2,4-D and related weed killers. The dinitro weed killers are also being much more widely used. Neotran, a miticide, has recently been offered commercially. Plant growth regulators for blossom thinning, fruit setting and pre-harvest fruit drop control also are major developments.

The Trenton plant of Monsanto was built in 1940 and 1941. A three year study of engineering, involving the availability of necessary raw materials and closeness to consuming industries, was the immediate basis for this location. Phosphoric acid is produced from phosphorus shipped in from its Tennessee plant. Various sodium and ammonium phosphates are produced from this acid.

Since the original construction numerous additions and expansions have been carried out, the most recent of which is a new unit to produce a controlled sudsing organic synthetic detergent.

Since the end of the war, Pennsylvania Salt has been actively expanding production facilities at Wyandotte. Largest of these is the installation of modern power generating equipment.

Additional equipment has been installed to increase output of Perchloron (high test calcium hypochlorite) and hydrogen peroxide. The new hydrogen peroxide facilities enable this plant to turn out a more concentrated product increasing the percent hydrogen peroxide from 29 to 35%.

Capacity for production of detergents was increased, and the same is true for chlorine and caustic soda with additional facilities for chlorine liquefaction and chlorine cylinder filling.

Still other expansions include increased capacity for production of sal ammoniac, liquid and anhydrous ferric chloric, and high grade ammonia. New facilities were installed for monochlorobenzene and for production of the Knox-Out brand of insecticide sprays.

Proof that the Detroit market still offers an opportunity to new chemical businesses is seen in the growth of Klem Chemicals, Inc. This company was founded in 1943 by T. C. McKenzie. It was incorporated July 1, 1947, and though still quite small showed a 100 percent increase in volume of business for 1947 over 1946. Klem serves the metal fabrication industries with cleaning materials and technical service on cleaning problems. The company employs ten graduate chemists and chemical engineers.

The 25 million dollar expansion program announced by Wyandotte in August, 1946, is approaching completion. An expansion in bicarbonate of soda and calcium carbonate was completed last year. A new mercury cell caustic soda and chlorine plant was brought into production this summer. The company's organic chemicals program reached large-scale production with completion of a plant to make ethylene and propylene glycols and a plant for Kreelon, a synthetic detergent of the alkyl aryl sulphonate type. Still under construction is an ethylene oxide unit.

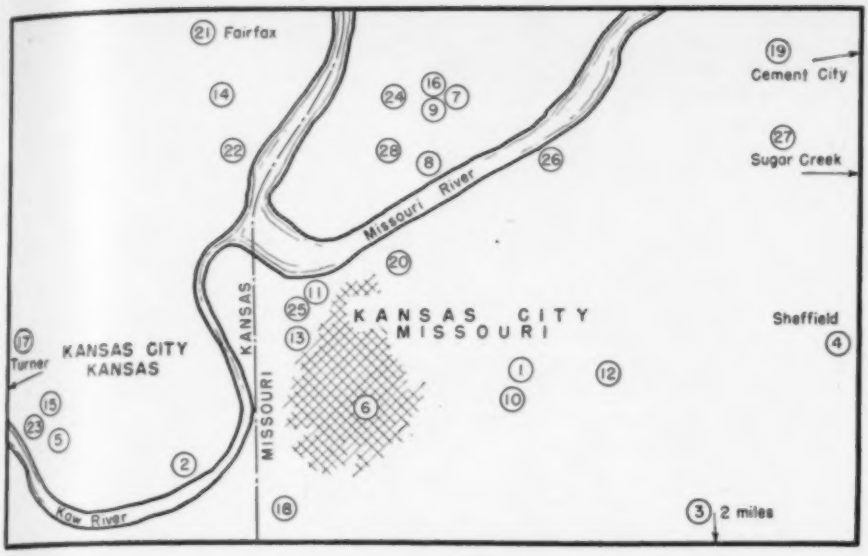
An expansion in soda ash output which will cost several millions of dollars and expand sales by 15 percent will be in production shortly.

The expansion program was financed partly by sale of $18 million worth of stock to Solvay American Corp., subsidiary of Solvay et Cie, a Belgian company. This was a major step for Wyandotte since all stock had previously been held by descendants of Capt. John B. Ford, founder of the company. Production of glycol at Wyandotte, much of which will be used in anti-freeze, is another instance of tieing-in market and chemical raw materials in the Detroit area.

Although the plant of Ethyl Corp. is not a production unit but strictly a research laboratory, its place in the Detroit area is proper because of its relationship to the automotive industry with respect to fuels and lubricants.

Reichhold Chemicals has as its principal line of products synthetic resins, plastics and plasticizers. They are in the midst of a $10,000,000 expansion program, a part of which is the $1,000,000 phthalic anhydride plant which is just being completed. Some of the other expansions are plants at Tuscaloosa, Ala., and Seattle, Wash. The former plant is designed to produce chemical pigments and the latter one, phenolic type adhesive resins. A new product just developed is Styresol which is a modification of alky resin and styrene.

The author wishes to express his appreciation to all of the companies mentioned above who were gracious enough to supply material for this article.



1. J. A. Adams Supply Co. Paint, varnish, lacquer
2. Air Reduction Sales Co. Gases
3. American Asphalt Co. Asphalt products
4. Certain-teed Products Co. Asphalt products
5. Colgate Palmolive Peet Co. Soap and Glycerine
6. Cook Chemical Co. Agricultural chemicals
7. Cook Paint and Varnish Co. Paint, varnish, lacquer
8. Corn Products Refining Co. Corn starch and others
9. Davis Paint Co. Paint, varnish, lacquer
10. W. S. Dickey, Clay Mfg. Co. Ceramics
11. Faultless Starch Co. Starch
12. Goetz Brewing Co. Brewery
13. Great Western Paint Mfg. Co. Paint
14. Gustin-Bacon Mfg. Co. Resin-bound insulation
15. Kansas Soya Products Inc. Vegetable Oils
16. Linde Air Products Co. Gases
17. Lone Star Cement Co. Cement
18. Midwest Precoat Co. Industrial chemicals
19. Missouri Portland Cement Co. Cement
20. Muehlebach Brewing Co. Brewery
21. Owens-Corning Fiberglas Co. Resin-bound insulation
22. Phillips Petroleum Co. Petroleum refinery
23. Procter and Gamble Mfg. Co. Soap and glycerine
24. Puritan Compressed Gas Corp. Gases
25. Sewell Paint and Varnish Co. Paint, varnish, lacquer
26. Speas Co. Acetic acid, vinegar
27. Standard Oil Co. Petroleum refinery
28. Waggener Paint Co. Paint

Kansas City Area

Sharp rise in farm income has jumped demand for agricultural chemicals in Kansas area.

GEORGE V. TAYLOR
Director of Market Research
Spencer Chemical Co.
Kansas City, Mo.

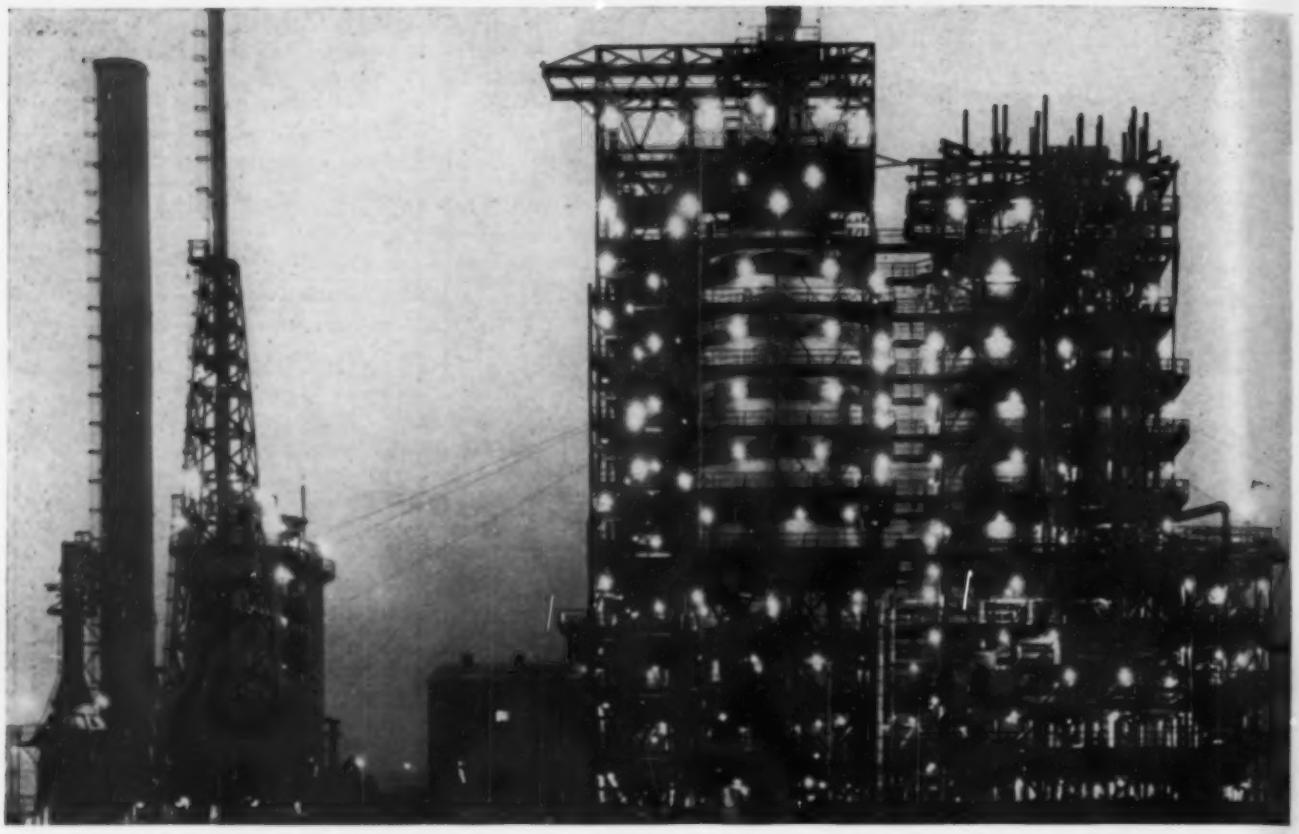
The knocking that's heard in Iowa, Missouri, Nebraska and Kansas these days is not the wind slamming the screen doors of deserted dustbowl farmhouses. Opportunity is astir in the nation's center with a "new look" for chemical industry.

It is no news to chemical industry that raw materials abound in the Midwest. The quality of transportation favored by topography and good roads is recognized; the excellence of the Midwest's pool of skilled and unskilled labor is acknowledged.

There is, of course, a modest chemical industry in the Kansas City region. This area with 5.6 percent of the nation's personal income has 2.0 percent of the chemical industry. To those chemical industries closely tied to consumer purchasing power, this lack of balance provides inducement for immediate chemical expansion. With few, but increasing, exceptions, plants are either extractive, in that processing beyond raw material is limited, or are finishing, in that they produce for the consumer market from relatively highly processed raw material. Conforming to historical patterns, distributors are becoming formulators and modifiers while extractors are becoming intermediate producers. The area industry is predominantly one of small producers. Over one-half of its plants cater to the drug, livestock remedy, consumer and industrial specialty markets. Construction on a new unit for methanol and dry ice production was completed this spring by Spencer Chemical Co. at Pittsburg. Standard Oil of Indiana has just completed the addition of a 25,000 bbl. per day fluid catalytic cracking unit and associated facilities to its Kansas City plant. Colgate-Palmolive-Peet expanded its production of synthetic detergents at Kansas City in late 1947. Chemurgic developments in Nebraska this spring were the completion of lease negotiations for the Omaha alcohol plant by Farm Crops Processing Corp. and the formation of Gateway Chemurgic Co. of Lincoln for processing oilseeds. Iowa has been active in the last two years with expansion of Du Pont's cellophane facilities at Clinton, Algonquin Chemical's sulphuric acid construction at Dubuque, Quaker Oat's furfural at Tama, Chemurgic Industries' corn sirup, lactic acid and glucose at Sioux City, Grain Processing Corp.'s alcohols and Witt's carbon dioxide at Muscatine, and eight widespread fertilizer, agricultural chemicals and products installations costing over 1¼ million dollars.

Such bustling, however encouraging, cannot change the fact that the area's economy is rooted fundamentally in agriculture and from it any substantial market expansion must derive. The Midwest farm cash income which was 1.4 billion dollars in 1940 had increased to 4.4 billion by 1946.

The impact of this rural well-being on the chemical industry will be considerable. Agriculture, already chemical industry's best customer, will use increasing amounts of chemicals in advancing its techniques and providing for its comfort. Marketers of petroleum products, well established through mechanization of the farm, have struck paydirt again in the installation of LP gas systems. Fertilizer consumption in the Kansas City area has increased 500 percent in the last seven years while U. S. consumption rose 50 percent. The extent of the market for insecticides, herbicides and fungicides is difficult to assay but U. S. consumption of economic poisons reached 127,000 tons in 1947. No one can doubt that a mass market exists for these chemicals, but marketers should remember that sales tonnages stem from the extensiveness of operations rather than heavy unit applications. On the other hand, value produced per acre averaged $29 for the area in 1945 against $12 in 1940 so that the cost burden an acre will bear has increased 250 percent. Finally, progressive methods and packaging in the food processing industry promise increased chemical markets and chemurgic raw materials.



About half the new cat crackers, backbone of petroleum refining, are going up in the Midwest. They range from some of the biggest (like Standard of Indiana's 25,000 bbl. per day unit at Whiting, above) to . . .

Fuel Developments in th

Midwestern industry and midwestern research are writing important chapters in the technology of petroleum, coal and natural gas.

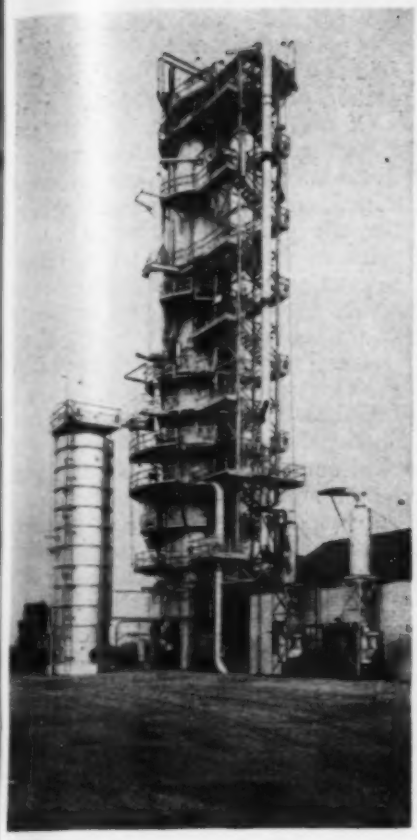
GUSTAV EGLOFF
Universal Oil Products Co.
Chicago, Ill.

MANY of the important fuel developments in the United States have taken place in the Midwest. At present, research on fuels, particularly petroleum is being greatly expanded. Oil, natural gas and coal fields are found in the midwestern states. A large number of petroleum refineries and coal and gas processing plants are located in this area. About 20 percent of the total United States refining capacity is located in the Midwest.

One of the largest petroleum research centers in the world is located at Chicago. From laboratories in this area and in other parts of the Midwest have come important contributions toward the development of high octane gasoline, jet fuels, better diesel fuels, and fuel oils for domestic and industrial use as well as a wide variety of lubricants. Petroleum research men are working on problems created by unprecedented demands for all types of fuels. The refiner must produce products of rigid specifications, gasolines to power our giant air transports as well as automobiles having high compression ratios. Some of the newer motor cars have compression ratios of 8.5 to 1 and require 93 research method octane gasoline with a resulting 20 percent increase in mileage. The industry must furnish the diesel oil for an ever-growing fleet of locomotives and ships. Despite the progress already made, the oil industry is fully aware that research must be stepped up and is expanding facilities to provide an even better all-type fuel economy.

Research Centers

The largest oil research laboratories in the Midwest are those of the Standard Oil Co. (Indiana) at Whiting. It was the first oil company to locate in the Chicago area and the first in the world to inaugurate a program of chemical research. Since its foundation in 1890, the company has con-



. . . One of the smallest (Aurora Gasoline Co.'s 2,500 barreler at Detroit).

t idwest

stantly expanded its research facilities. Part of a group of new buildings are already in use. When the current expansion is completed, there will be 340 scientists and 800 technicians and assistants engaged in research and development.

During the years, Standard has made many important contributions to petroleum technology. The most noteworthy was the Burton cracking process. In recent years, it has made significant improvements in catalytic cracking, isomerization, hydroforming, and other processes. Standard Oil chemists have also developed a number of improved lubricants. Among these are motor oils with cleansing agents for the removal of engine deposits and an oil that permits operation at −70 to −100 F.

The Sinclair Oil and Refining Co. also carries on extensive research in the Chicago area. Its new laboratories at Harvey cost about $4-million and will house a research staff of over 550 people, half of whom will be technically trained. Sinclair has played an important role in the development of cracking, alkylation, and other processes. It has also contributed to the improvement of lube oils through the development of additive compounds.

The Pure Oil Co. is building a new research center at Crystal Lake, Ill., to be completed in 1949. This project consists of four buildings and will cost $2 million. The present staff will be increased substantially and researches will be carried out in every phase of the industry from exploration through marketing. Of primary importance are some of its processes for increasing oil recovery such as the acid treatments of limestone and sandstone. Studies on blending hydrocarbon fractions were important in increasing aviation gasoline stocks. For a number of years, much study has been devoted to the development of extreme pressure lubricants for high speed, high torque gears. Despite success on this project, research continues in anticipation of even more severe requirements.

The Universal Oil Products Co., a pioneer in petroleum research is also located at Chicago. It is unique in that it does not operate any refineries nor manufacture any products but is devoted wholly to research, development, engineering, and service. Its earliest important contribution to the industry was the Dubbs thermal cracking process which has had worldwide use. Universal was the first to invent and develop catalytic polymerization, the alkylation reaction of paraffins with olefins, and synthetic cracking catalysts. It has also made valuable improvements in catalytic cracking, isomerization, and dehydrogenation processes. It was the first to commercialize the use of antioxidants to stabilize motor fuels. This company plans substantial expansion of its facilities.

Analytical Tools

Of great importance to petroleum research are analytical tools. Podbielniak, Inc., located in Chicago, has developed and marketed throughout the world, high precision equipment for both routine analytical work and research in the oil industry. Its instruments make possible accurate and rapid analyses of petroleum gases and gasolines and lubricating oil fractions. It is continuing research in the interests of increasing accuracy and reducing time of analyses. It has recently developed a centrifugal extractor which is applicable to solvent refining of petroleum and pilot plant investigations of solvent and extraction processes.

At the Standard Oil Co. (Ohio) in Cleveland, about 200 of a staff of 2,400 employees in the manufacturing department alone are working on research and development. One of the problems solved during the last few years was the search for a more economical way to desulphurize home-heating oils and other fuels. At present, the most important problems are maximizing refinery output and improving the performance of gasoline. Also at Cleveland are the laboratories of the National Advisory Committee for Aeronautics which has a budget of about $40 million for 1948. These laboratories conduct outstanding research on fuels for aircraft.

The American Petroleum Institute will grant $43,000 to Ohio State University during the coming year for study of the synthesis, physical properties and anti-knock value of low molecular weight hydrocarbons. A number of oil companies in the Midwest support research at foundations, colleges, and universities and award annual fellowships as well.

Catalytic Cracking

Catalytic cracking is now the key process in petroleum refineries. The gasoline produced has an 80 octane rating whereas thermally cracked has

Midwest Fuel Statistics

State	Petroleum Refining Capacity, Bbl./Day	1947 Crude Oil Production, Bbl.	Coal Reserves Billion Tons
Illinois	333,000	65,460,000	205
Indiana	278,600	6,413,000	55
Kansas	201,900	104 328,000	35
Michigan	112,300	16,154,000	—
Nebraska	4,400	220,000	—
Ohio	229,700	3,081,000	95
Missouri	—	—	80
Iowa	—	—	34
Total	1,159,900	195,656,000	504

New Midwest Cat Crackers

Company	Location	Capacity Bbl./Day
Gulf Refining Co.	Cincinnati, Ohio	15,000
	Toledo, Ohio	15,500
Ohio Oil Co.	Robinson, Ill.	12,400
Phillips Petroleum Co.	Kansas City, Kan.	24,000
Pure Oil Co.	Newark, Ohio	5,000
Rock Island Refining Co.	Indianapolis, Ind.	5,000
Sinclair Refining Co.	East Chicago, Ind.	25,000
Socony-Vacuum Oil Co.	Augusta, Kan.	10,000
Standard Oil Co. (Ind.)	Whiting, Ind.	25,000
	Sugar Creek, Mo.	25,000
	Lima, Ohio	20 000
Sun Oil Co.	Toledo, Ohio	30,000
Total		211,900

about 68 octane and the former has higher lead susceptibility. About one half of the new construction of catalytic cracking plants is in the Middle West.

Catalytic cracking processes are principally of two types, Fluid Flow and Thermofor. The fluid catalytic cracking units process from 2,500 to over 25,000 bbl. of gas oil a day. One of 42,000 bbl. per day is being designed. The costs of these installations are now comparable with those of thermal cracking of similar capacity. Fluid catalytic cracking units have been constructed in which the regenerator and reactor are built one above the other. This type of plant is particularly adapted to small scale operation.

As elsewhere, exploration for new fields of crude oil is being carried on at a high tempo. Output in the Midwest was about 10 percent of the national total in 1947.

Synthesis of Oil

One of the most important developments in the use of natural gas is the American version of the Fischer-Tropsch synthesis. By this process, gasoline, fuel oils and oxygenated chemicals will be produced from natural gas from the Hugoton field in southwestern Kansas. The gas to be processed has a relatively low heating value and is not well suited for domestic consumption. It will be collected from an area of about 300 sq. mi. by an integrated pipeline system. The Stanolind Oil & Gas Co., a subsidiary of the Standard Oil Co. (Indiana), will process 100 million cubic feet of natural gas a day at the plant in Garden City, Kan.* Estimated cost of the plant alone is $32,000,000. It is designed to produce 5,300 bbl. of gasoline, 800 bbl. of fuel oils, 1,060 bbl. of light hydrocarbons such as butanes, and 500,000 lb. of oxygenated hydrocarbons daily. The essential operations include production of synthesis gas and its conversion as in Fluid catalytic cracking.

Kansas is the only midwestern state with natural gas in quantity. It has about 8 percent of the known United States reserves which are estimated to be over 170 trillion cubic feet.

An important development in natural gas storage for peak loads has been accomplished by the Public Service Co. of Northern Illinois. This company has installed underground high pressure pipe sections (24 in. diameter) for storage of 40 million cubic feet of natural gas maintained at 2,240 psi. at 40 deg. F. The installation of conventional gas holders costs three to five times more at the present time. A considerable part of the economy results from the fact that the natural gas does not follow the ideal gas laws at the conditions given; the stored volume is actually 43 percent greater than that calculated for a perfect gas.

Coal Research

Coal research is directed toward both more efficient consumption and newer methods for its utilization. Equipment design is a particularly important phase of the work done on coal. For example, 45 years ago the first steam turbines were installed in Chicago for electric power generation with a heat input rate of about 35,000 Btu. per kwh., whereas the turbine generators now under construction are expected to have a heat input rate of about 10,000 Btu. per kwh. A new method has also been devised using a cyclone burner which has been in successful operation over four years. With this type burner, all of the ash is slagged and drawn off. One of the principal advantages is that coal is burned in ¼-in. mesh and thus the pulverization problem is reduced. The most efficient of these units is said to cut coal consumption to about 25 percent of what it was forty years ago.

All developments resulting from coal research are of importance to the Midwest which has about 16 percent of the nation's estimated reserves. Illinois has the greatest bituminous reserves in the United States. Although they are inferior in quality to eastern deposits, methods of preparation and equipment for utilization have been developed so that the Illinois coal is the basic source of power for industry in this area.

Coal Gasification

Other significant researches are coal gasification and carbonization. Among the midwestern companies engaged in coal research are the Commonwealth Edison Co., Peoples Gas Light and Coke Co., Babcock and Wilcox in Chicago, and others.

At the Institute of Gas Technology, a project of particular interest is the investigation of the principle of continuous flash pulverization for subsequent combustion or gasification. A study of the gasification of coke or coal by steam using the fluid technique shows promise of utilizing fines. A char maker has been developed for the partial or complete devolatilization of bituminous coal while in the fluid state with recovery of tar, high Btu. gas and a smokeless dust which may be burned as such, briquetted or used as a low volatile coal in the production of metallurgical coke.

Of major importance is the study of the steam-oxygen-carbon reactions to determine the equilibrium concentration, enthalpy changes and gasification rates of carbon as affected by temperature, steam-oxygen ratios, velocities and pressure. Three reactors are in service, the largest designed to operate at a maximum pressure of 600 lb. at temperatures from 1,800 to 2,600 deg. F. This study is sponsored by the American Gas Association Gas Production Research Committee.

Bituminous Coal Research, Inc., has an annual budget of about half a million dollars for various research projects. These include grants to Battelle Institute, Purdue University, and the Institute of Gas Technology.

Oil From Coal

The conversion of coal to liquid fuels is under study by private industry and the government. The method showing greatest promise at the present time involves the gasification of coal by oxidation to carbon monoxide and hydrogen, followed by fluid flow Fischer-Tropsch synthesis. Another method involves the low temperature carbonization of coal to produce maximum yields of distillate products and coke. The latter is then reacted with steam to make carbon monoxide-hydrogen for synthesis. There is also a direct hydrogenation process in which a paste of coal and oil is treated with hydrogen at high temperatures and pressures.

One of the government's research centers is located at Louisiana, Missouri. A coal hydrogenation plant has been built and another plant for the production of liquid fuels by coal gasification and Fischer-Tropsch synthesis is to be constructed. The coal hydrogenation unit cost $7 million and was designed to produce 200 bbl. of oil a day. The coal gasification and synthesis units are to be designed and constructed at a cost of $4.5 million. This demonstration plant will produce 80 bbl. of gasoline and fuel oil daily.

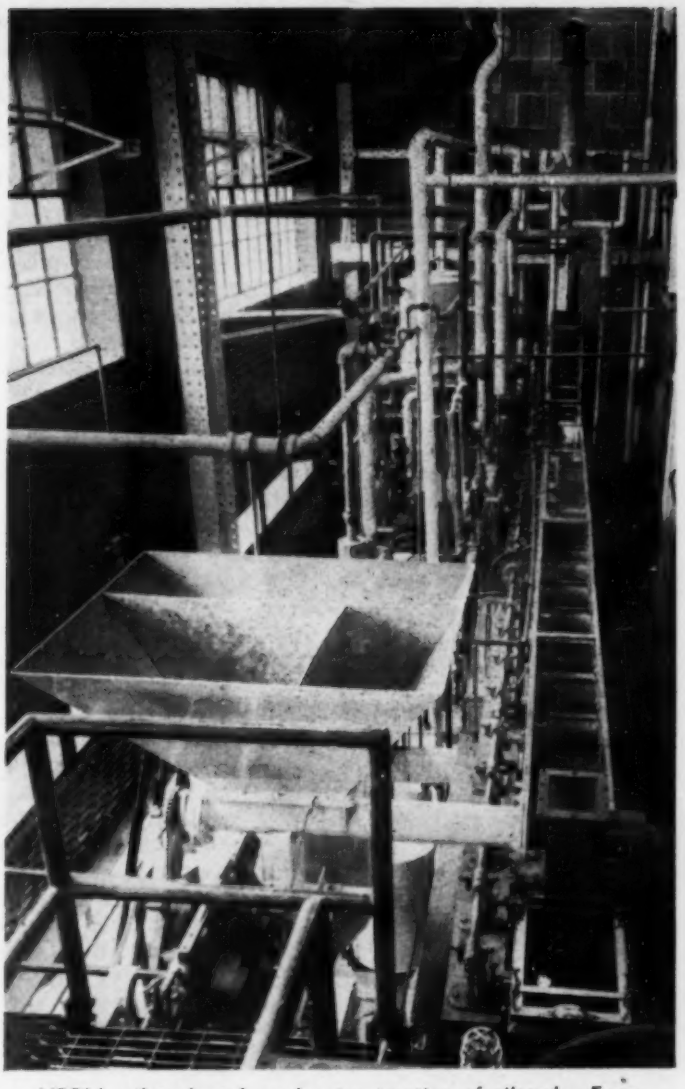
Research in the fuel industries is, from a standpoint of time, in its early stages. The increasing realization of its importance is assurance that ample supplies of better fuels, and far more efficient methods of utilizing them will be forthcoming. These future developments are of importance to the Midwest where requirements are high for the agricultural industry, manufacturing, transportation, and domestic heating.

* Since the receipt of this manuscript, plans for construction of this plant have been discontinued. See *Chementator*, page 76.

Midwest Chemurgy

From nylon to penicillin — a swelling stream of new products based on the crops and residues of Midwest farms.

G. E. HILBERT
Northern Regional Research Laboratory
Peoria, Ill.



NRRL's pilot plant for solvent extraction of oilseeds. From it, and others like it, has emerged chemurgy's lustiest offspring—the fast growing soybean industry.

World War II's impact stimulated the development of new and extended markets and outlets for the great midwestern crops—corn, wheat, and soybeans; and for the agricultural residues—corncobs, wheat straw, and flax straw. The main agricultural processing industries utilizing these commodities have been greatly expanded, and many new products and byproducts have been developed. Some new industries also have been established.

Of all these, the soybean industry has shown the most spectacular growth and progress. The greatest single factor which induced this change was the overrunning of the Dutch Indies and the Philippine Islands by the Japanese early in the war, thus cutting off our sources of coconut and palm oils and creating a shortage of oils and fats in this country. The only domestic oilseed which could be grown in large enough quantities to meet this deficit was the soybean. Through the combined efforts of farmers, industry, and the U. S. Dept. of Agriculture the soybean industry was expanded to a level which satisfied our bare needs for oils and fats. In the emergency the production of soybeans was almost tripled—a record that stands as one of the many great achievements of the Midwest during the war.

This whole development was made possible by the vision and faith in the future of the soybean of a few industrialists such as A. E. Staley, Sr.; the American Soybean Asso., an organization of producers; and the agronomists, W. A. Morse of the Bureau of Plant Industry, Soils, and Agricultural Engineering of the U. S. Dept. of Agriculture, and W. L. Burlison of the Illinois Agricultural Experiment Station. The discovery by plant geneticists of the Lincoln and other newer varieties of soybean which produce in high yield and contain more oil per pound, together with the improvements in processing and utilization of the oil and meal facilitated the recent expansion of the soybean industry.

Most valuable component of the soybean is its oil. It is mainly for its oil that the soybean is grown. In 1944, soybean oil assumed a position of greater importance in our domestic vegetable oil and fat economy when its production exceeded that of cottonseed oil. In comparison with soybean oil, cottonseed oil is usually sold at a premium. This is because cottonseed oil has greater flavor stability and, therefore, is preferred for food uses. Some progress has been made in recent years toward improving the flavor stability of soybean oil, but much remains to be done. Indeed, the flavor problem is the most important one facing the industry. The present dom-

infant position of soybean oil can be maintained only if this problem is solved. Accelerated researches being conducted by industry; by Dr. Daubert and colleagues at the Univ. of Pittsburgh; and by Drs. Cowan, Dutton, and others at the Northern Regional Research Laboratory (NRRL) offer real hope that the flavor stability of soybean oil can be improved markedly.

Recovery Methods

Of great significance in the eventual solution of this problem is the decided trend in the industry toward recovering the oil by mild solvent extraction procedures rather than by the more drastic pressing methods. This is the most important change that is now taking place in the soybean processing industry. Practically all new units being constructed or planned are of the solvent-extraction type. It is probable that within a few years the major portion of soybeans will be processed by solvent-extraction methods. The solvent most favored is hexane. Some of the smaller units in the industry, because of the reduction of the fire hazard, prefer trichloroethylene.

The use of alcohol as a solvent for extracting the oil also has been given consideration and shown to have promise. This process was developed on a laboratory scale at NRRL and then investigated on a pilot-plant scale in cooperation with Allied Mills. By the use of alcohol, a colorless flour can be prepared which, because of its bland flavor, has enhanced value as a food.

An interesting development in the processing of soybean oil concerns its fractionation by liquid-liquid extraction. Laboratory and pilot-plant investigations on this procedure have been conducted independently by the Pittsburgh Plate Glass Co., The M. W. Kellogg Co., and NRRL. Pittsburgh Plate Glass translated its development to a commercial scale a few years ago, furfural being utilized as the main agent for separating soybean oil into food oil and drying oil fractions. The process of the M. W. Kellogg Co. involves the use of liquid propane and has been found useful in refining fatty acids and separating the vitamin and sterol fractions of vegetable, animal, and fish oils. Plans for the construction of a number of commercial units which will use the Kellogg process are started and are well under way.

Largest use of soybean oil is in the production of food products. The increased use in margarine, shortening, and salad oil during the past few years has been striking. Improvements in the processing of the oil for these various purposes made possible the development of products acceptable to the trade.

Paint Oil

In the production of paints and varnishes, soybean oil, which by itself is considered to be an inferior paint oil, has been finding expanding usage. A major factor in this development has been the enhancement of its drying characteristics by formulation in alkyd resins. Other factors of direct interest to the protective coating industry are improved varnish and paint oils from the copolymerization of styrene, maleic anhydride, tung oil, and other monomeric materials with soybean oil, and from the interaction of polyalcohols, dibasic acids, and unsaturated fatty acids with soybean oil. Favoring increased consumption in this field is the non-yellowing characteristic of soybean oil paints.

A new industrial use for soybean oil is in the production of a novel type of heat-sealing resin. Pioneering laboratory work on this resin was conducted at NRRL. General Mills, Inc. has translated this development through the pilot-plant stage to a commercial scale. Construction of a new General Mills' plant at Kankakee, Ill., having a monthly capacity of 100,000 lb. of this heatsealing resin was completed July 1, 1947. This synthetic resin is known in the trade as Polyamide Resin. Its main use is in the food packaging field and its future appears to be very bright.

As a result of the tremendous expansion of the soybean industry during the war, huge quantities of meal and flour became available for feed and food purposes. The increased production of soybean meal came at a time when protein supplements were critically short, and thus farmers were enabled to feed their enlarged herds more efficiently.

Utilization of soy flour for many diversified food uses in recent years has been stimulated by the shortage and high price of most protein foods. A new field for soy flour was opened when government regulations were modified to permit the use of as much as 3½ percent of soy flour as a sausage binder and in meat products. Increasing quantities of soy flour are being used in bakery goods, foods, for pets, confectionery, macaroni, etc. Multi Purpose Food, which has soy flour as its base and is a recent entrant in the food field, has found ready favor in the European Recovery Program. Because it is highly seasoned, it may not have wide acceptance in this country. All soy flour mills are now running at capacity with an estimated production of 400 million pounds a year. A large proportion of the soy flour, however, is being purchased by the government for shipment to Europe. As curtailment of this program may lead to overproduction, the Soy Flour Assn. is now energetically pushing the development of new and extended outlets for soy flour, in order to insure a more permanent market.

Soybean protein bids fair to become the most abundant, the most widely used, and the cheapest protein. Fundamental investigations by Dr. A. K. Smith of the NRRL on the preparation and properties of soybean protein has provided a basis for its industrial production. The sole producer of soybean protein before the war was the Glidden Co. Within the past year at least two other concerns, the Buckeye Cotton Oil Co. and The Drackett Co. have started to produce soybean protein. Many diversified uses are being found for soybean protein. Large quantities are being utilized in the paper-coating and adhesive fields. During the war, the greater share of the production of soybean protein was allocated to the Navy for use in a fire extinguisher mixture, where it served to provide a heavy, durable foam. This mixture was developed by the National Foam System, Inc., utilizing soybean protein produced by the Glidden Co. A year ago the Western Cartridge Co. began the use of soybean protein as an adhesive in the production of shotgun shell casings. This development resulted from cooperative investigations with NRRL. Within the past few months NRRL has found that a new type of heat-gellable protein can be produced from some types of soybean meal. This protein has promise as an adhesive in the crown seal industry and in the manufacture of meringues and confections.

Penicillin

In the fermentation field, the outstanding development by far in recent years has been the establishment of the new industry for the production of the antibiotics—penicillin and streptomycin. This was one of the truly great accomplishments during the war.

Within a year after work on improving the procedure for producing penicillin was initiated at NRRL, the basic method which is still being used by industry was developed. The best nutrients for growing the penicillin-producing molds were found to be

corn steep liquor, a byproduct of the corn wet-milling industry, and milk sugar. With this medium and through the use of a strain of *Penicillin chrysogenum* which grew well under submerged culture conditions, the yield of penicillin was increased more than 100-fold over that obtained by the British. Basic patents on the production of penicillin have been granted to Dr. A. J. Moyer of NRRL and assigned to the Secretary of Agriculture for free use by the public. The rapidity with which this new industry grew has been phenomenal; 41,426 billion units of penicillin was produced in 1947, as compared with 21 billion units in 1943 and none in 1942.

The development of streptomycin, a discovery of Dr. Selman Waksman, followed that of penicillin. The main nutrients used for growing the molds that produce streptomycin are derived from agricultural sources. The recent increase in the production of this antibiotic has been spectacular.

Fermentation Growth

During the war the munitions program necessitated production of large quantities of alcohol. Difficulty was experienced in this program when a shortage of corn developed in 1942. The only large source of carbohydrate material available at the time was wheat. However, few grain distilleries had had any experience with the fermentation of wheat. Experimental trials showed that difficulty could be expected in the processing of wheat for the production of alcohol. These difficulties were due primarily to the gummy characteristics of wheat gluten. The WPB urged industry to carry out intensive researches on the fermentation of wheat, along with colleges and government agencies, and requested NRRL to act as the coordinating agency in the exchange of information between the various research participants. Through whole-hearted and genuine cooperation within the group this problem was solved within a matter of months and optimum conditions were established for the effective fermentation of wheat. Approximately 200 million bushels of wheat were used as a source of alcohol over a period of two years (1944-45). Although comparatively little wheat is being used at present as a raw material for the production of alcohol, the know-how developed should be useful in future national emergencies.

The picture of the increase in size of the midwestern corn wet-milling industry is obtained by considering the grind of corn; in 1940 the industry ground about 80 million bushels; in 1947 it ground 140 million bushels, equivalent to 200 carloads of corn per day. This expansion has been largely due to the increased demand for corn sirup and dextrose. The enlarged output of corn sirup and sugar prevented the shortage of sweetening agents from becoming acute during the war.

In recent years several significant advances have been made by this industry. Waxy corn, which was developed by the Iowa Agricultural Experiment Station and the Bureau of Plant Industry, Soils, and Agricultural Engineering is now being used for the production of a novel type of specialty starch having properties somewhat similar to those of tapioca starch. About 1 million bushels of waxy corn are now being grown for the production of waxy corn starch. This product is being marketed by the American Maize Products Co. and National Starch Products, Inc.

The promise which grain sorghums hold as a crop for the Southwest has led the Corn Products Refining Co. to look to this cereal as a source of starch. Through the combined efforts of the Corn Products Refining Co., the Kansas Agricultural Experiment Station, NRRL, and of the Midwest Research Institute procedures have been developed for the production of starch from sorghum.

Long Term Significance

Of long-term significance in the development of new products of the corn wet-milling industry is the unique plan used by the industry for increasing rapidly the fund of fundamental information on the structure and properties of starch. At the suggestion of Dr. C. S. Hudson and under the leadership of Norman F. Kennedy of the Corn Industries Research Foundation, a Starch Round Table is held each fall at which the starch and carbohydrate experts of this country exchange views and information on the recent findings on starch.

The Starch Round Table has stimulated many new researches in the field and has advanced greatly our knowledge of this most abundant natural high polymer.

An unusual development during the war was the production of dextrose from wheat. This process was based on a procedure developed by C. E. Rist of NRRL for the rapid separation of the starch and gluten in wheat flour. This method was translated to an industrial scale by J. F. Walsh at the Doughnut Corp. of America, and was also utilized by Boeckeler Associates. The starch at the Doughnut Corp. of America was converted to dextrose and at Boeckeler Associates to alcohol. The byproduct gluten, which resulted from these two operations, was used by International Minerals and Chemical Corp. as a raw material for the production of sodium glutamate. The Doughnut Corp. of America has suspended its activities in the dextrose field within the past year, and the former interest of Boeckeler Associates has been transferred to the Trenton Chemical Co., which is continuing to produce alcohol and gluten from wheat flour at the same plant.

Agricultural Residues

In recent years an increasing quantity of agricultural residues has been used for industrial purposes. Of considerable interest is the change in raw materials used for the production of furfural. Prior to the war, the main raw material used was oat hulls. Because of the shortage of feeds and the higher price which oat hulls could command in this market, the Quaker Oats Co. turned to corncobs as a raw material for furfural. The tremendous increase in the amount of furfural used for the processing of petroleum lubricants and in the purification of butadiene during the war necessitated the construction of a new plant. This plant was constructed at Memphis, Tenn., by the government and was operated by the Quaker Oats Co. About a year ago this furfural plant was purchased by this company from the War Assets Administration. Recently a new large market for furfural has opened up. Furfural will be used for the production of adiponitrile, a raw material utilized in the manufacture of nylon. The E. I. du Pont de Nemours & Co. has under construction a plant at Buffalo, N. Y., where furfural will be converted to adiponitrile. The quantity of corncobs required to produce the furfural needed for this outlet is estimated by Du Pont to be 100,000 tons annually.

The most important development in the strawboard industry has been the gradual solution of its problem on the procurement of wheat straw. This has been accomplished largely through the cooperative efforts of agricultural equipment manufacturers, state agricultural experiment stations, and NRRL. The introduction of the combine harvester posed a serious problem for the industry in its collection of wheat straw. By the proper use of the one-man pickup baler and an educational campaign in the wheat-producing areas, the raw material problem is rapidly being solved.

Pulp and Paper in the Midwest

Still growing, its progress in reforestation, byproduct utilization, hardwood pulping and waste disposal is evidence of the industry's continuing vitality.

RICHARD W. PORTER
Assistant Editor, Chemical Engineering

NEARLY one-third of the paper mills in the country are located in the Midwest. The industry here is relatively old, yet its vitality is unimpaired. It has faced many problems, but its continuing progress is unmistakable. Perhaps the best way to evaluate the state of the industry is to examine its characteristics, its problems, and its progress.

By nature, the pulp and paper industry is not concentrated in big industrial centers. Instead, mill locations are most often selected with respect to two prime raw materials, cellulose fiber (wood, straw, etc.) and water. Thus, paper mills are usually located on rivers or streams in areas where fibrous raw materials are (or formerly) were abundant. Many paper mills, however, and especially converting plants are found near consumer centers without regard to raw materials.

In the Midwest, the industry can be divided in three main groups. Wisconsin, Minnesota, and Northern Michigan produce most of the wood pulp manufactured in the area. Illinois and Indiana produce the bulk of the nation's output of strawboard. Ohio and Michigan manufacture little of their own pulp requirements, but

Pulp and Paper Mills Located in the Midwest

1. Waldorf Paper Products Co.....St. Paul, Minn.
2. The B. F. Nelson Mfg. Co...Minneapolis, Minn.
3. Watab Paper Co.....Sartell, Minn.
4. Hennepin Paper Co.....Little Falls, Minn.
5. Northwest Paper Co.....Brainerd, Minn.
6. Blandin Paper Co.....Grand Rapids, Minn.
7. Minnesota & Ontario Paper Co. International Falls, Minn.
8. Northwest Paper Co.....Cloquet, Minn.
9. Wood Conversion Co.....Cloquet, Minn.
10. Marathon Corp.....Ashland, Wis.
11. Ontonagon Fibre Corp.....Ontonagon, Mich.
12. Munising Paper Co. .....Munising, Mich.
13. Sterling Pulp & Paper Co....Eau Claire, Wis.
14. Cornell Wood Prod Corp.....Cornell, Wis.
15. Pearey Paper Mills, Inc.....Ladysmith, Wis.
16. Flambeau Paper Co.....Park Falls, Wis.
17. Nekoosa-Edwards Paper Co.....Nekoosa, Wis.
18. Nekoosa-Edwards Paper Co..Port Edwards, Wis.
19. Consolidated Water Power & Paper Co. Wisconsin Rapids, Wis.
20. Stevens Point Pulp & Paper Co.Stevens Pt., Wis.
21. Wisconsin River Paper & Pulp Co. Stevens Pt., Wis.
22. Consolidated Water Power & Paper Co. Stevens Pt., Wis.
23. Whiting-Plover Paper Co.....Stevens Pt., Wis.
24. Mosinee Paper Mills Co.....Mosinee, Wis.
25. Marathon Corp.....Rothschild, Wis.
26. Wausau Paper Mills Co.....Brokaw, Wis.
27. Ward Paper Co.....Merrill, Wis.
28. Tomahawk Pulp Co.....Tomahawk, Wis.
29. Tomahawk Kraft Paper Co.....Tonahawk, Wis.
30. Rhinelander Paper Co.....Rhinelander, Wis.
31. Container Corp. of America.....Chicago, Ill.
32. Masonite Corp.....Chicago, Ill.
33. Standard Asbestos Mfg. Co.....Chicago, Ill.
34. Johns-Manville Corp.....Waukegan, Ill.
35. Hummel & Downing Co.....Milwaukee, Wis.
36. Hoberg Paper Mills.....Green Bay, Wis.
37. Northern Paper Mills.....Green Bay, Wis.
38. Fort Howard Paper Co.....Green Bay, Wis.
39. Little Rapids Pulp Co.....Little Rapids, Wis.
40. Nicolet Paper Corp.....De Pere, Wis.
41. U. S. Paper Mills Corp....West De Pere, Wis.
42. Thilmany Pulp & Paper Co.....Kaukauna, Wis.
43. Sangamon Paper Mills.....Kaukauna, Wis.
44. Kimberly-Clark Corp.....Kimberly, Wis.
45. Combined Locks Paper Co..Combined Locks, Wis.
46. Consolidated Water Power & Paper Co. Appleton, Wis.
47. Fox River Paper Co.....Appleton, Wis.
48. Institute of Paper Chemistry....Appleton, Wis.
49. Riverside Paper Corp.....Appleton, Wis.
50. Gilbert Paper Co.....Menasha, Wis.
51. Marathon Corp. .....Menasha, Wis.
52. John Strange Paper Co.....Menasha, Wis.
53. Geo. W. Whiting Paper Co.....Menasha, Wis.
54. Wisconsin Tissue Mills.....Menasha, Wis.
55. Bergstrom Paper Co.....Neenah, Wis.
56. Kimberly-Clark Corp. .....Neenah, Wis.
57. Neenah Paper Co.....Neenah, Wis.
58. Wolf River Paper & Fibre Co....Shawane, Wis.
59. Falls Paper & Power Co.....Oconto Falls, Wis.
60. Badger Paper Mills, Inc.....Peshtigo, Wis.
61. Marinette Paper Co.....Marinette, Wis.
62. Marinette Paper Co.....Menominee, Mich.
63. Hoskins Paper Co.....Menominee, Mich.
64. Kimberly-Clark Corp. .....Niagara, Wis.
65. Escanaba Paper Co.....Groos, Mich.
66. Manistique Pulp & Paper Co..Manistique, Mich.
67. United States Gypsum Co..N. Kansas City, Mo.
68. Volney Felt Mills, Inc.....N. Kansas City, Mo.
69. Lawrence Paper Co.....Lawrence, Kansas
70. Hinde & Dauch Paper Co...Fort Madison, Iowa
71. Central Fibre Products Co.....Tama, Iowa
72. Maizewood Insulation Co.....Dubuque, Iowa
73. International Paper Co.....Rockford, Ill.
74. Rockton Felt & Paper Co.....Rockton, Ill.
75. Burgess Cellulose Co.....Freeport, Ill.
76. Beloit Box Board Co.....Beloit, Wis.
77. Forest Products Laboratory.....Madison, Wis.
78. Hopper Paper Co.....Taylorville, Ill.
79. Quaker Oats Co.....Pekin, Ill.
80. Bemis Bros. Bag Co.....Peoria, Ill.
81. Barrett Div., Allied Chem. & Dye Corp. Peoria, Ill.
82. Terre Haute Paper Co.....Peoria, Ill.
83. Certain-teed Products Corp.....Marseilles, Ill.
84. National Biscuit Co.....Marseilles, Ill.
85. Morris Paper Mills.....Morris, Ill.
86. Lehon Co. .....Wilmington, Ill.
87. Prairie State Paper Mills, Inc.....Joliet, Ill.
88. Ruberoid Co. .....Joliet, Ill.
89. Consolidated Paper Co.....Aurora, Ill.
90. Central Fibre Products Co.....Quincy, Ill.
91. Alton Box Board Co.....Carlyle, Ill.
92. American Asphalt Roof Corp..East St. Louis, Ill.
93. Certain-teed Products Corp..East St. Louis, Ill.
94. Alton Box Board Co.....Alton, Ill.
95. Central Fibre Products Co.....Mt. Carmel, Ill.
96. Central Fibre Products Co.....Vincennes, Ind.
97. Fort Wayne Corrugated Paper Co.Vincennes, Ind.
98. Terre Haute Paper Co.....Terre Haute, Ind.
99. Alton Box Board Co.....Lafayette, Ind.
100. Container Corp. of America.....Wabash, Ind.
101. Fiber Form Inc.....Columbia City, Ind.
102. Hartford City Paper Co.....Hartford City, Ind.
103. International Paper Co.....Hartford City, Ind.
104. Ball Brothers Co.....Eaton, Ind.
105. Beveridge Paper Co.....Indianapolis, Ind.
106. Ball Brothers Co.....Noblesville, Ind.
107. Kieffer Paper Mills.....Ewing, Ind.
108. Container Corp. of America.....Carthage, Ind.
109. Ferdinand Funke's Sons Co.....Evansville, Ind.
110. American Box Board Co....Grand Rapids, Mich.
111. Rockford Paper Mills.....Rockford, Mich.
112. Mac Sim Bar Paper Co.....Otsego, Mich.
113. Otsego Falls Paper Mills.....Otsego, Mich.
114. Michigan Paper Co.....Plainwell, Mich.
115. Kalamazoo Vegetable Parchment Co. Parchment, Mich.
116. Allied Paper Mills.....Kalamazoo, Mich.
117. Bryant Paper Co.....Kalamazoo, Mich.
118. Hawthorne Paper Co.....Kalamazoo, Mich.
119. Kalamazoo Paper Co.....Kalamazoo, Mich.
120. Rex Paper Co.....Kalamazoo, Mich.
121. Sutherland Paper Co.....Kalamazoo, Mich.
122. Western Board & Paper Co...Kalamazoo, Mich.
123. Michigan Carton Co.....Battle Creek, Mich.
124. Watervliet Paper Co.....Watervliet, Mich.
125. French Paper Co.....Niles, Mich.
126. American Can Co.....South Bend, Ind.
127. Volney Felt Mills.....Mishawaka, Ind.
128. American Coating Mills, Inc.....Elkhart, Ind.
129. Eddy Paper Corp.....White Pigeon, Mich.
130. American Can Co.....Constantine, Mich.
131. International Paper Co.....Three Rivers, Mich.
132. Lee Paper Co.....Vicksburg, Mich.
133. Central Paper Co.....Muskegon, Mich.
134. Filer Fibre Co.....Filer City, Mich.
135. North American Pulp & Paper Co. Cheboygan, Mich.
136. Fletcher Paper Co.....Alpena, Mich.
137. Port Huron Sulphite & Paper Co. Port Huron, Mich.
138. Dunn Sulphite Paper Co.....Port Huron, Mich.
139. Rochester Paper Co.....Rochester, Mich.
140. Detroit Sulphite Pulp & Paper Co.Detroit, Mich.
141. Ford Motor Co. Rouge Plant...Dearborn, Mich.
142. Consolidated Paper Co.....River Rouge, Mich.
143. Peninsular Paper Co.....Ypsilanti, Mich.
144. Consolidated Paper Co.....Monroe, Mich.
145. Monroe Paper Products Co.....Monroe, Mich.
146. Monroe Paper Co.....Monroe, Mich.
147. River Raisin Paper Co.....Monroe, Mich.
148. Simplex Paper Corp.....Palmyra, Mich.
149. Augiaize Box Board Co.....St. Mary's, Ohio
150. United States Gypsum Co.....Gypsum, Ohio
151. Hinde & Dauch Paper Co.....Sandusky, Ohio
152. Weaver-Wall Co. .....Avery, Ohio
153. Jaite Co. .....Jaite, Ohio
154. Thomas Phillips Co.....Akron, Ohio
155. Walsh Paper Co.....Cuyahoga Falls, Ohio
156. Munroe Falls Paper Co.....Munroe Falls, Ohio
157. Chase Bag Company.....Chagrin Falls, Ohio
158. Beckett Paper Co.....Hamilton, Ohio
159. Champion Paper & Fibre Co....Hamilton, Ohio
160. Sall Mountain Co.....Rockdale, Ohio
161. Harding-Jones Paper Co....South Excello, Ohio
162. Crystal Tissue Co.....Excello, Ohio
163. Gardner-Richardson Co.....Middletown, Ohio
164. Sorg Paper Co.....Middletown, Ohio
165. Wardlow-Thomas Paper Co....Middletown, Ohio
166. The Wrenn Paper Co.....Middletown, Ohio
167. Cheney Pulp & Paper Co.....Franklin, Ohio
168. Franklin Board & Paper Co.....Franklin, Ohio
169. Logan-Long Co. .....Franklin, Ohio
170. Maxwell Paper Co.....Franklin, Ohio
171. Miamisburg Paper Co.....Miamisburg, Ohio
172. Ohio Paper Co.....Miamisburg, Ohio
173. Oxford-Miami Paper Co.....W. Carrollton, Ohio
174. Aetna Paper Co.....Dayton, Ohio
175. Bauer Bros. Co.....Springfield, Ohio
176. Howard Paper Co.....Urbana, Ohio
177. United Paperboard Co.....Urbana, Ohio
178. Queen City Paper Co.....Tippecanoe City, Ohio
179. International Paper Co.....Cincinnati, Ohio
180. Philip Carey Mfg. Co.....Lockland, Ohio
181. Fox Paper Co.....Lockland, Ohio
182. Gardner-Richardson Co. .....Lockland, Ohio
183. Cincinnati Paper Board Co...Crescentville, Ohio
184. Williams Felt & Paper Co.....Brookville, Ind.
185. Mead Corp. .....Chillicothe, Ohio
186. Chillicothe Paper Co.....Chillicothe, Ohio
187. Container Corp. of America....Circleville, Ohio
188. Fairfield Paper Co.....Baltimore, Ohio
189. Leighton Fibre Products Co....Columbus, Ohio
190. Ohio Wax Paper Co.....Columbus, Ohio
191. Dresden Paper Mills Co.....Dresden, Ohio
192. Coshocton Straw Paper Co.....Coshocton, Ohio
193. Muskingum Fibre Products Co...Coshocton, Ohio
194. Massillon Paper Co.....Massillon, Ohio
195. Ohio Box Board Co.....Rittman, Ohio
196. Loroco Industries, Inc.....Lancaster, Ohio
197. Liberty Paper Board Co. Inc..Steubenville, Ohio
198. Toronto Paper Mfg. Co.....Toronto, Ohio
199. Central Fibre Products Co....Hutchinson, Kas.
200. American Envelope Co.....W. Carrolton, Ohio

utilize a substantial quantity of waste paper. Deinking of waste paper plays a significant part in providing fiber for various types of paper produced here.

Except for strawboard mills and some of the integrated mills that make both pulp and paper, practically all paper producers must obtain a bulk of their pulp requirements from outside the area.

The main trend of expansion in the Midwest is toward further integration. That is, companies that formerly provided bulk paper to converting mills are entering more and more into the production of finished consumer product. With lower margins of profits, and higher costs, many manufacturers are finding it necessary to streamline operations. Along this same line is a trend toward production of specialties and finer quality papers. Certain manufacturers that in the past produced standard grades of paper have found it more profitable to develop special products that have unique qualities, and that dont compete so directly with standard grades. This sometimes enables a plant with old, slow-speed machines to avoid direct competition with modern, more efficient high-production mills.

Many new paper machines have been installed or projected. Kimberly-Clark Corp. started its new two-machine book paper mill at Niagara, Wis., this year in addition to the expansion of its Lakeview Mill at Neenah, Wis. Consolidated Water Power and Paper Co. last year started up another machine at its Biron, Wis., plant. Two newsprint machines were converted to making book paper at the Wisconsin River Paper Co. by Consolidated Water Power and Paper Co., its present owner.

Rhinelander Paper Co. is enlarging its production of glassine with a new machine. Included also in the building program at Rhinelander is the new yeast plant, a cooperative effort by several mills in the area to utilize waste sulphite liquor. Marathon Corp.'s new carton plant at Menasha, Wis., is one of its major additions, and a new paper machine at Menominee, Mich., will add considerable to this company's production capacity. In addition, Marathon's Chemical Division is continually developing its line of chemical products derived from waste sulphite liquor. Early this year, Thilmany Pulp and Paper Co. at Kaukana, Wis.,

increased its capacity by starting up a new kraft paper machine.

In Ohio, Chillicothe Paper Co. increased production by over 50 percent as a result of installing a new paper machine. American Envelope's new mill at West Carrollton, Ohio, doubled its output of fine papers. Mead Corp. rebuilt and modernized several machines and installed a new soda pulp bleach plant. The same company rebuilt and converted one paper machine at its Escanaba, Mich., plant to produce machine coated papers.

Board mill expansion has not been common, but the new cylinder machine of the Alton Box Board Co. has brought a substantial increase to the tonnage of board produced in this area. Similarly, the new machine at the Michigan Carton Co. plant at Battle Creek, Mich., will effectively boost board production.

The above examples are just an indication of the growth and vitality of the paper and pulp industry in the Midwest. However, practically all mills are expanding or modernizing.

Wood Supply

One of the major problems of the industry is wood supply. Available supplies of softwood are not abundant like they once were and even with heavy imports from Canada the consumption of home grown wood is greater than new growth. The pulp wood situation stands out in the light of Canada's attitude towards decreasing wood export to this country.

In the meantime, both industry and community have taken steps to assure a future pulp wood supply. One of the most important steps has been the reforestation program. While individual companies such as Nekoosa-Edwards Paper Co. and others have developed their own projects in reforesting idle land to provide a sustained yield of wood, one of the factors that has made Wisconsin a leader in this work is the fact that the community and industry have pooled efforts to sustain the natural resources. Leading organization that has spearheaded the drive to replant trees is Trees for Tomorrow, Inc., a non-profit organization formed by the cooperative effort of certain pulp and paper mills in the Wisconsin River Valley. This organization, is composed of the Consolidated Water Power and Paper Co., Whiting Plover Paper Co., Marathon Corp., Wassau Paper Mills Co., Ward Paper Co., Tomahawk Kraft Paper Co., Tomahawk Pulp Co., and Rhinelander Paper Co. It has furnished many millions of seedlings to farmers, schools and communities, who in turn have handled planting operations. In addition, member mills of Trees for Tomorrow, Inc., have reforested thousands of acres of land to form the basis for a sustained yield of wood.

Hardwood Pulp

Perhaps one of the most important technological advances contributing to the raw material supply is the development of processes for satisfactory chemical pulping of hardwood such as poplar. Processes have been studied for many years, but only recently have they been applied commercially. Now, several mills in Wisconsin are operating digesters on these more plentiful types of woods. Actually, the hardwoods are the only species in the lake states that are growing faster than they are being used.

There is a trend toward semi-chemical pulping processes. One company, Otsego Falls Paper Mills, Inc., in the Kalamazoo Valley, that formerly made strawboard, has converted its pulping unit to a semi-chemical process. Using hardwoods that are plentiful in this area, such as birch, beech, maple and others, this mill obtains high yields of pulp to furnish two machines that turn out various types of board. Construction of a new semi-chemical pulp mill has recently been started by the Green Bay Pulp & Paper Co., Green Bay, Wis. The process is claimed to produce yield of as high as 80 percent and is suitable for use on hardwoods. Corrugating and liner board will be the principal product of this mill.

Wisconsin has been a leader in developing methods for utilizing waste sulphite liquor. Latest project is the building of a yeast plant by the Lake States Yeast Corp. at Rhinelander. Designed to produce about four tons of yeast per day from the waste liquor from 50 tons of sulphite pulp, this plant will use liquor from the Rhinelander Paper Co. and is scheduled to go into operation in fall. Lake States Yeast Corp. was formed by a group of sulphite mills to carry on work toward the commercial utilization of sulphite liquor.

Vanillin has been successfully made from sulphite liquor for a number of years by the Salvo Chemical Corp., Rothschild, Wis., using lignin in the waste liquor from Marathon's mill. Marathon's chemical division has carried utilization much farther and is making a variety of products from the lignosulphonate compounds separated by fractional precipitation from the sulphite liquor. These compounds have found a variety of uses such as dispersing agents, tanning agents, boiler water compounds and oil well drilling compounds.

Although the utilization of sulphite liquor has been successful in certain instances as indicated above, it is still one of the biggest problems of the sulphite pump mills in the Wisconsin area. Considerable research has been undertaken over a period of years, both from the standpoint of utilization and disposal. The important fact is that there is so much of it. Even though it can be utilized for a number of purposes, none of these is sufficiently large to take care of more than a fraction of the liquor produced. It has been estimated that less than 5 percent of the sulphite liquor in the United States is now being utilized.

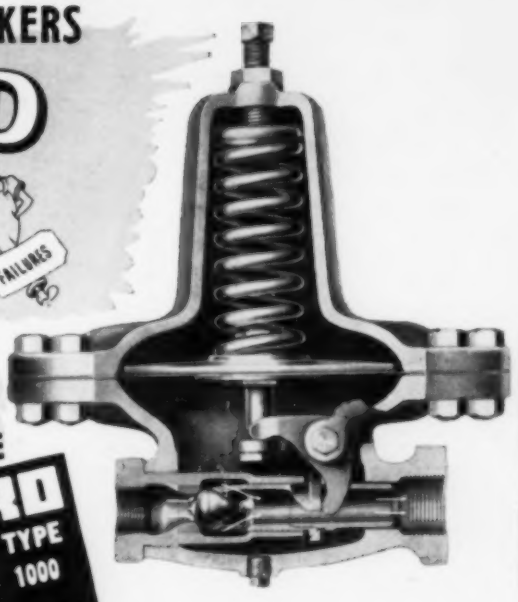
Deinking waste has been a major problem for the mills in Michigan and Ohio. While the paper board industry is the biggest tonnage user of waste paper, deinked paper is an important raw material for the manufacture of book and magazine papers in this section. A good deal of work has been directed to the abatement or disposal of deinking wastes by the mills in that area in cooperation with the National Council for Stream Improvement. A pilot plant for the aerobic digestion of the waste cooking liquor has been operated at the Michigan Paper Co., Plainwell, Mich., and has been successful in removing a large percentage of the components of the liquor. A full scale unit is planned for the future.

Strawboard wastes have been tackled by the National Council for Stream Improvement. Studies have been made with the result that sedimentation followed by anaerobic digestion seems feasible. So far the work has been done on a laboratory scale and a pilot plant will be built to further test the process.

Research

While a good many of the mills in the Midwest carry on extensive research and development programs and several of the universities participate in this research, the two most important organizations that serve this industry are the Institute of Paper Chemistry, Appleton, Wis., and the U. S. Forest Products Lab., Madison, Wis. While these two organizations serve far broader fields, the fact that they are located in the Midwest gives them first hand knowledge of conditions and problems of the section. Both these organizations have carried on extensive work in connection with different phases of the problems heretofore discussed. Their contribution to the welfare of the industry cannot be overestimated.

THESE TROUBLEMAKERS OUSTED



FROM PLANTS EQUIPPED WITH THE CASH STANDARD Streamlined TYPE 1000 PRESSURE REDUCING VALVE

. . . USER STATEMENTS THAT FOLLOW . . . TELL WHY

A MANUFACTURER OF RUBBER PRODUCTS SAYS—

"It is very easy for us to check every one of the 10 points because of the fact that the CASH STANDARD Type '1000' Streamliner which we purchased from your company replaced an old style hand operated valve which took constant manual attention to guarantee accurate pressure results. We do not hesitate for a minute to compliment you on manufacturing an excellent product and, as our needs increase, so will our use of CASH STANDARD Streamlined Valves."

ANOTHER MANUFACTURER IN CHECKING OUR 10 POINTS SAYS —

"The CASH STANDARD Valve is one of the finest pieces of equipment in use in our new plant. CASH STANDARD valves are not new to us; for over 38 years they have played a leading part in our production."

A MANUFACTURER OF MACHINES CHECKS ALL OF THE 10 POINTS AND SAYS—

"We use these '1000' valves in the smaller sizes on compressed air lines. They are indeed a pleasant surprise and I check fully with your 10 points. I have no intention of switching to another design."

WE CHECK WITH EVERY ONE OF THE 10 POINTS WRITES A MANUFACTURER FROM ONTARIO

"We do not have many of these valves at present but our maintenance department has asked that they be used wherever possible in replacements. It is claimed that they are not only very simple in their construction, but that they take up so little room. After reading your list of questions it was suggested that we check every one of them."

- ✔ 1. **Maximum capacity when needed most.**
- ✔ 2. **Accurate pressure control under toughest working conditions.**
- ✔ 3. **Trouble-free service.**
- ✔ 4. **Smooth operation.**
- ✔ 5. **Tight closure.**
- ✔ 6. **Speedier production results.**
- ✔ 7. **Elimination of failures.**
- ✔ 8. **Cost-saving operation.**
- ✔ 9. **No spoilage.**
- ✔ 10. **Practically zero in maintenance.**

Send FOR BULLETIN 962

CASH STANDARD CONTROLS . . . VALVES

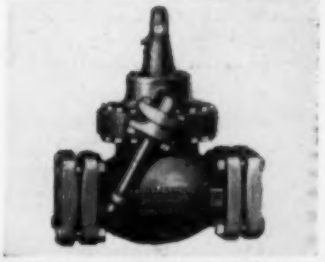
A. W. CASH COMPANY
DECATUR, ILLINOIS

BULLETINS AVAILABLE ON OTHER CASH STANDARD VALVES

Send for them

Bulletin 963 features the CASH STANDARD Type 100 Series of Super-Sensitive Controllers — various types for automatically operating valves, dampers, rheostats, stokers, pulverizers, fans, and other apparatus. 16 pages filled with descriptions and applications.

Bulletin 968 features the CASH STANDARD Type 34 Pressure Reducing Valve — direct operated — direct acting for handling steam, hot water, cold water, air, oil, brine —and most liquids and gases except some injurious chemicals. Illustrates and describes the different styles available and tells about their applications. Three pages of capacity charts.



Bulletin 956 features the CASH STANDARD Type 4030 Back Pressure Valve — designed to automatically maintain a constant pressure in the evaporator corresponding to a constant temperature desired. Shows an Ammonia and Freon Gas Capacity Chart based on ABSOLUTE pressures.

1 Concentrate of tantalite ore serves as the principal raw material for production of tantalum.

2 Ore from Brazil, Belgium Congo and Australia must first be reduced in size in a jaw crusher.

Tantalum

FOR MORE ABOUT FANSTEEL PLANT
SEE ARTICLE ON PAGE 110.

TANTALUM is recovered from tantalite ore by a subsidiary of Fansteel Metallurgical Corp. at North Chicago, Ill.

Principal raw material for the production of metallic tantalum is tantalite ore. It is found in many countries. The leading sources are Brazil, Belgium Congo and Australia. There have been some medium grade ores found in this country in the Black Hills of South Dakota. Always associated with columbium, the ore contains iron and manganese tantalates and columbates.

A concentrate arrives at the plant in cloth bags. It is reduced in size, first in a jaw crusher and then in a Raymond hammer mill. The 200-mesh powder is put into oil-fired fusion pots with caustic soda. The crude sodium tantalate and sodium columbate is given a series of leachings with water. Tantalum and columbium bearing salts form a mud. All liquid material is washed out with hot water in an agitated steel tank. It is pumped to the waste system.

In a rubber-lined, agitated tank the brown mud is digested with hot hydrochloric acid. Acid-soluble impurities consisting of iron, manganese, etc., are removed by decantation using a rubber hose as a siphon. In both this tank and in the one used in the preceding operation live steam serves to increase the agitation and to heat the materials.

At this point tantalum and columbium are in the solid state and mixed together. The mud, now white, is composed of tantalic and columbic acids. They are dissolved in hydrofluoric acid in a rubber-lined steel tank. Here the required amount of potassium carbonate is added to form the double salt of K_2TaF_7 and $K_2CbOF_5H_2O$. This salt is in solution. The hot solution is filtered in a wood plate and frame press, equipped with paper and cloth, to remove impurities. The mixed hot solution flows by gravity into hard rubber-lined crystallizing tanks. On cooling, the potassium tantalum fluoride, which is very insoluble at room temperature, crystallizes, leaving the soluble potassium columbium oxyfluoride in solution. The latter is siphoned off and pumped into a rubber-lined tank. Lead coil heaters are used for indirect heating. The solution is evaporated somewhat and the columbium residue pumped to the recovery system.

The K_2TaF_7 crystals are filtered in a circular rubber-lined steel tank in which the filtering medium is canvas supported by a heavy laminated canvas impregnated with phenolic resin.

Crystals are put in wooden frames with Masonite bottoms and dried in an air heated oven. The fluoride is reduced to metal powder by electrolysis of the fused salt in an iron pot. The powdered metal in the form of a cake is crushed and pulverized in a Raymond mill. This crude tantalum metal is separated from the fluoride salt by tabling on a Deister table. Pulverized metal is more easily washed free of residues with water. Drying is done in chemical stoneware bowls over steam coils. This powdered metallic tantalum is 99.9 percent pure.

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September 1948

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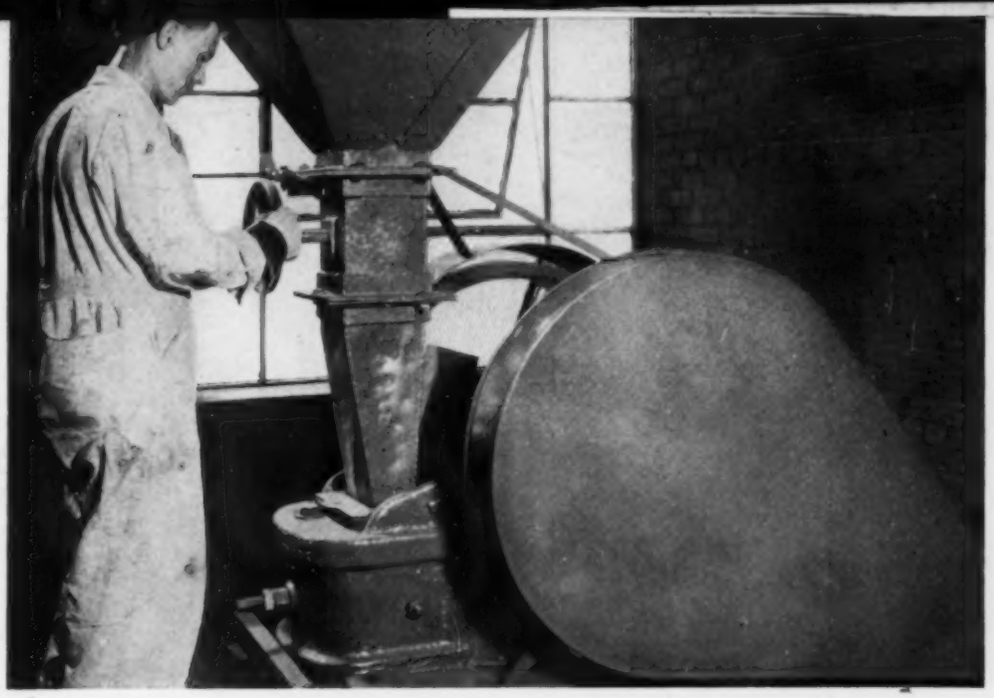
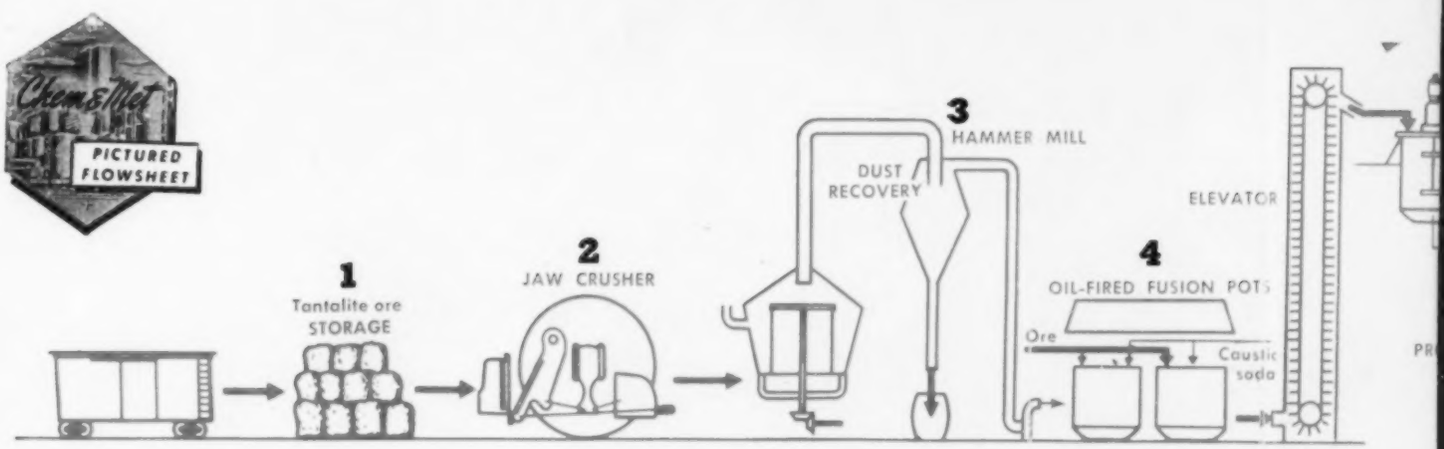


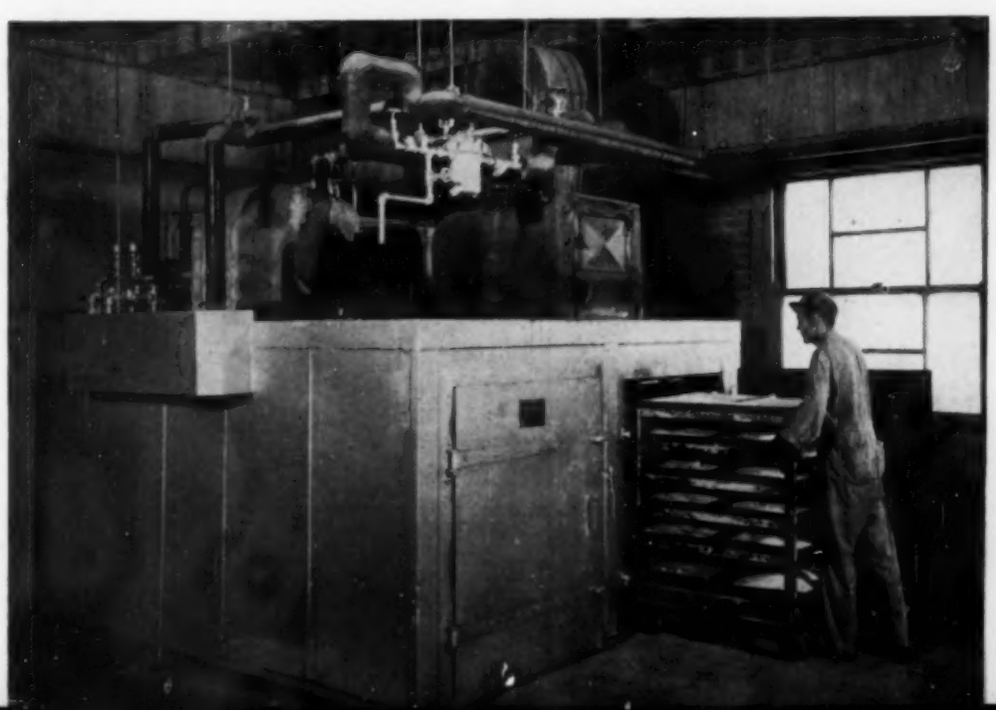
3 Crushed ore must be further reduced in a hammer mill to 200 mesh powder before it can be chemically treated. The powder is next conveyed to the fusion pots on the same floor.

4 The chemical treatment commenc
The crude sodium tantalate is then l

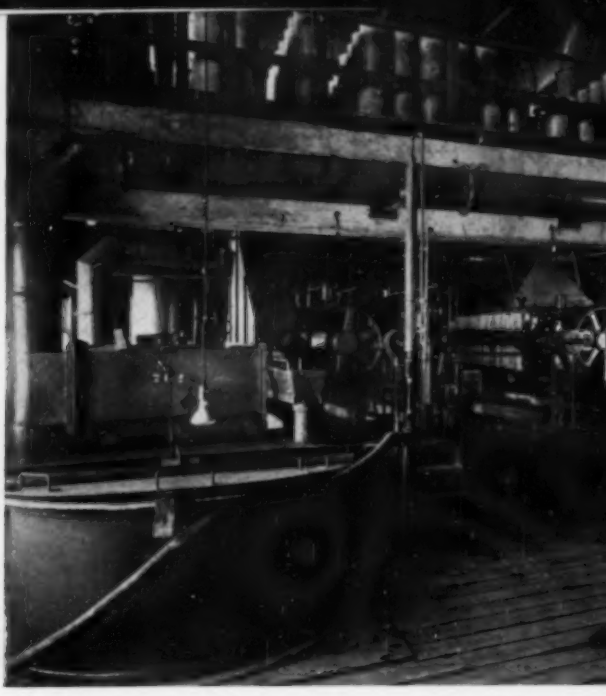


7 The K_2TaF_7 crystals free from the soluble potassium columbium oxyfluoride put into wooden frames with Masonite bottoms are dried in an air heated oven.

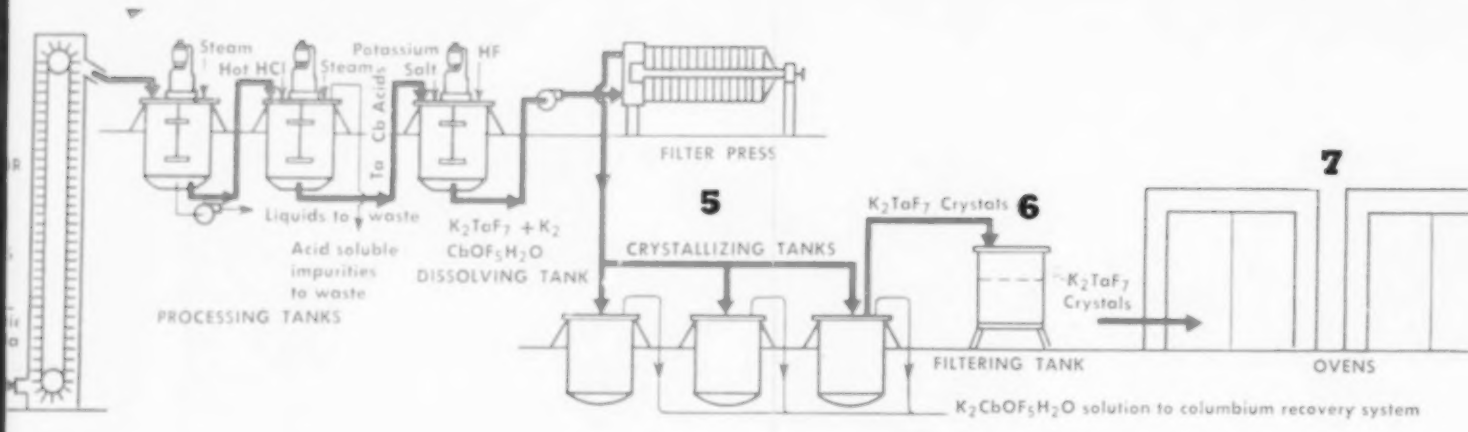
8 Tantalum metal powder is produc
fluoride in an iron pot. The carbon



eatment commences with the fusion with caustic soda in oil-fired pots. antalate is then leached with hot water in a steel tank.



5 Hot liquors containing tantalum and columbium salts into rubber-lined crystallizing tanks. K_2TaF_7 crystallizes out

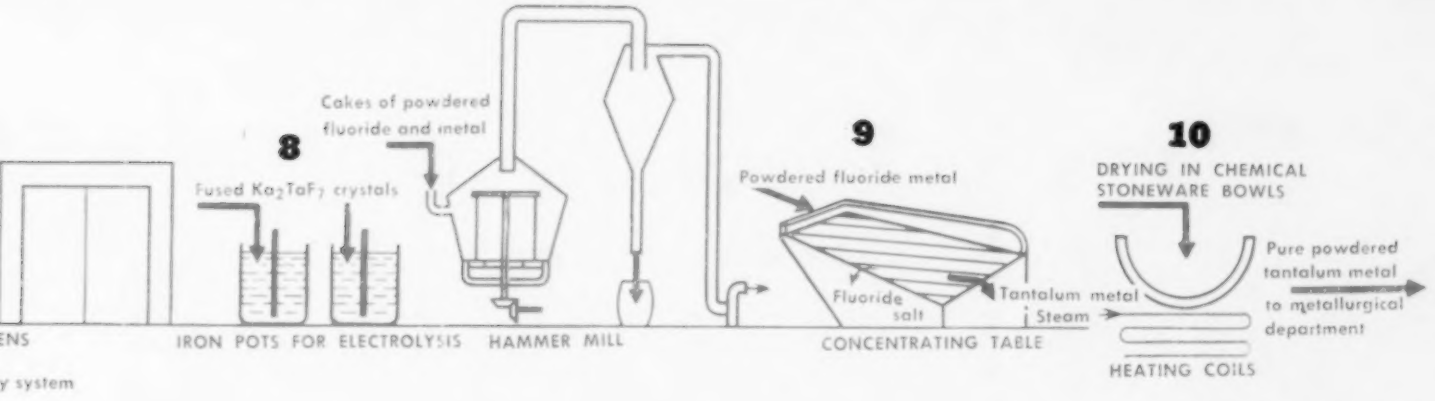


powder is produced by electrolysis of the fused salt of potassium tantalum pot. The carbon electrode is shown in the pot.

9 The powdered metal in the form of a cake is crushed an crude tantalum metal is separated from the fluoride salt

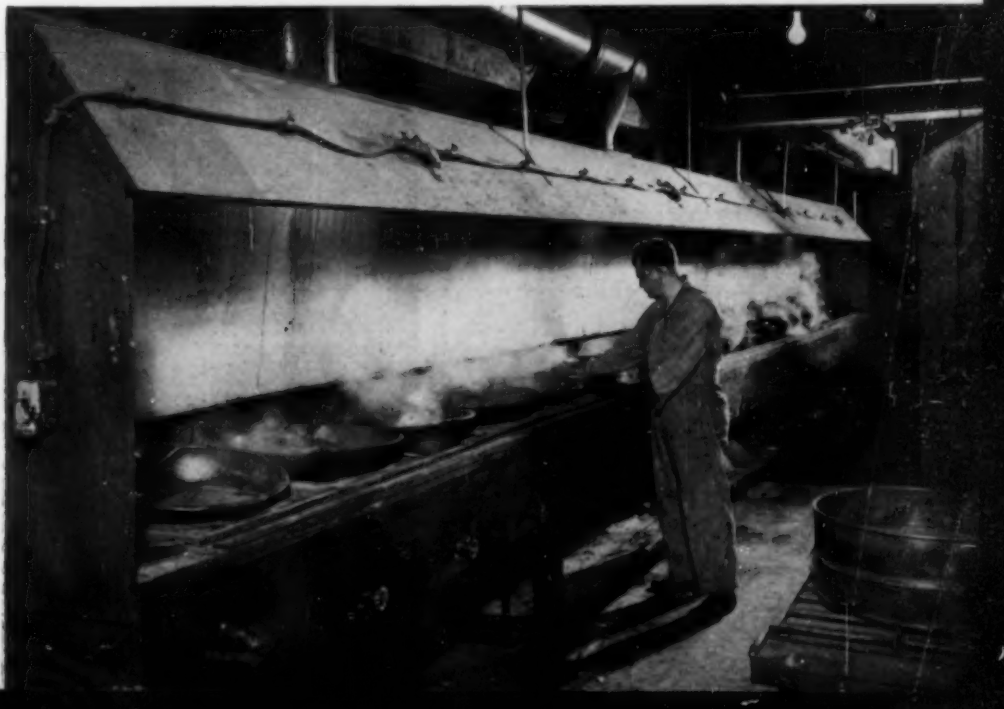
mbium salts in solution are filtered, then run ystallizes out leaving columbium salt in solution.

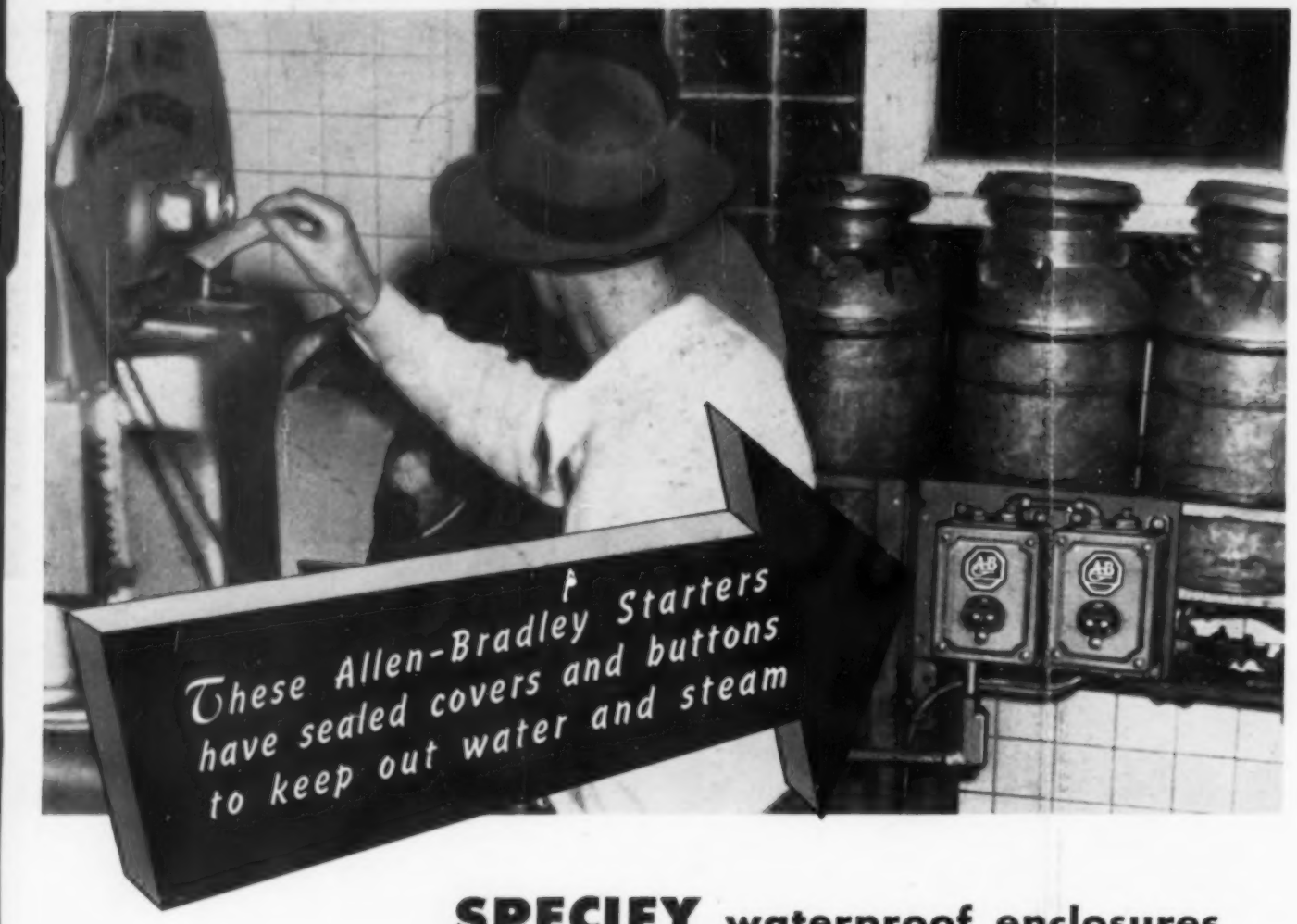
6 K_2TaF_7 crystals are unloaded from the steel tank into a vacuum pan filter. The crystals are placed in a wooden tray by the operator.



is crushed and pulverized in a hammer mill. This fluoride salt by tumbling on a Deister table.

10 Drying is done in chemical stoneware bowls over steam coils. This powdered metallic tantalum is 99.9 percent pure.





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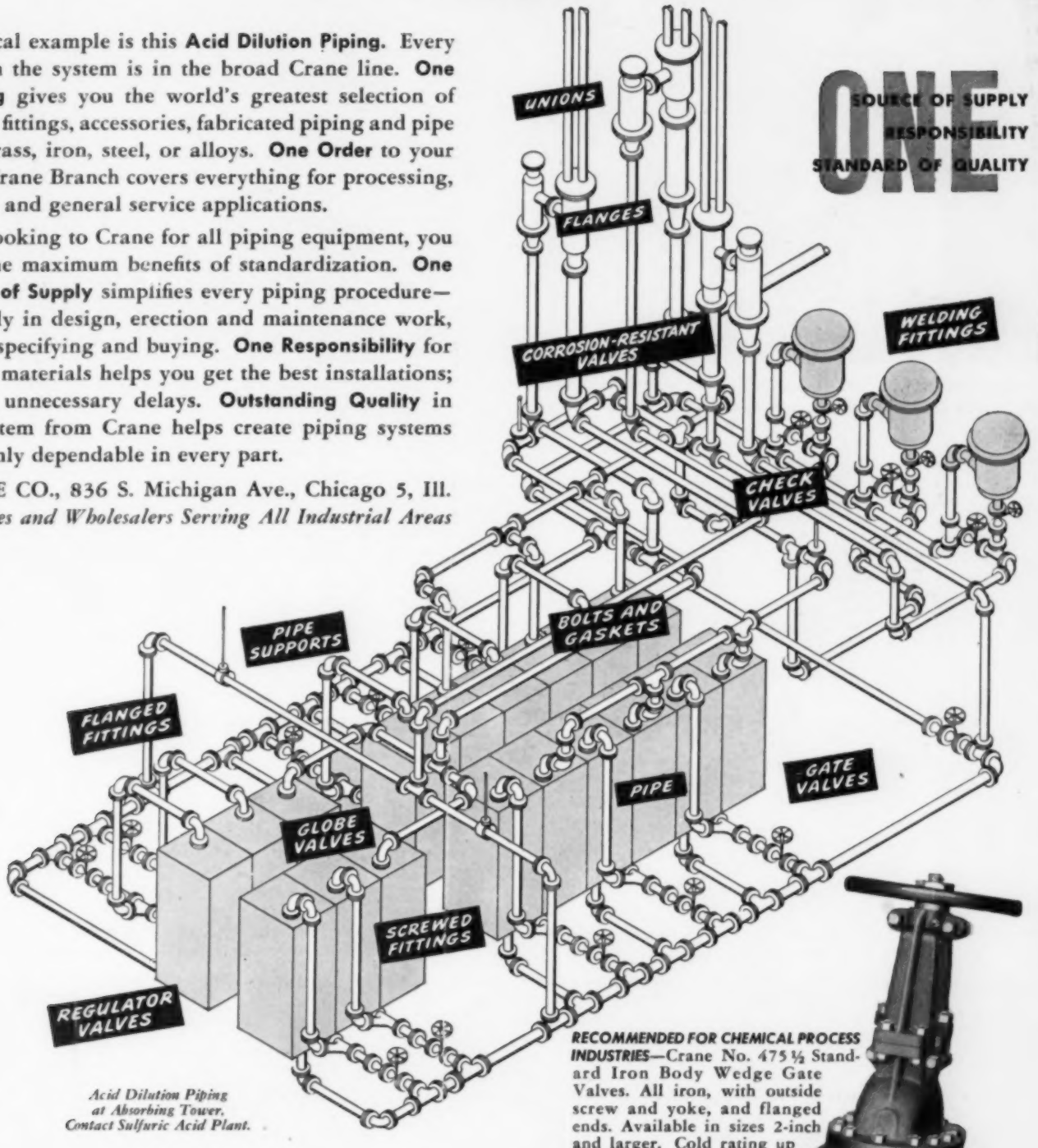

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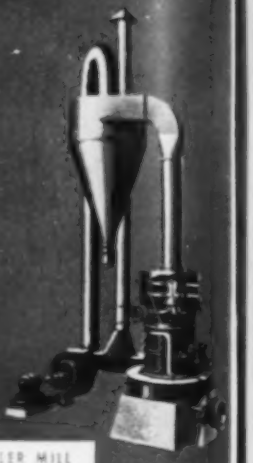
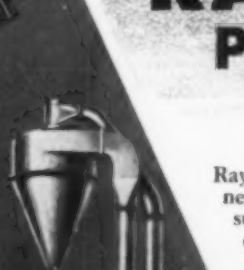


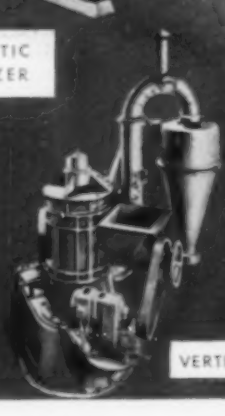
ROLLER MILL

BOWL MILL

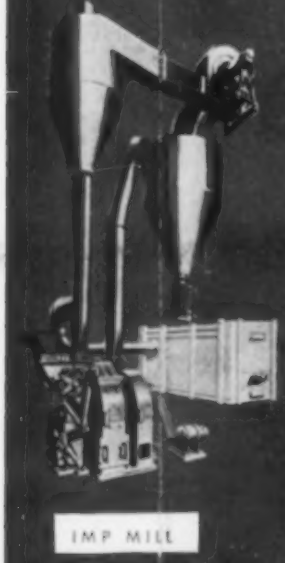
LABORATORY MILL



AUTOMATIC PULVERIZER



VERTICAL MILL



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Air separation provides close fineness control and uniform finished materials . . . from 20-mesh through intermediate grades to 400-mesh . . . with particle sizes 95% to 99% finer than 5 to 10 microns, as produced on the new Vertical Mill.

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PROCESS EQUIPMENT NEWS

Theodore R. Olive, ASSOCIATE EDITOR

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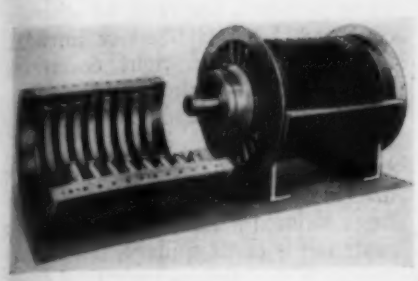


1. Axial Flow Compressor

AXIAL FLOW compressors in capacities from 1,000 to 300,000 cfm., and pressures up to 100 psig. in a single unit, are now being produced by Frederic Flader, Inc., 583 Division St., North Tonawanda, N. Y. These machines are said to utilize a new principle in industrial compressor design and to result in extremely high operating efficiencies. For example, the unit shown in the accompanying illustration, which is only 22 in. long between flanges, with a case diameter of 17 in., delivers 18,000 cfm. at 25 psig. pressure. Operating efficiencies with such units are claimed to be up to 88 percent, with savings in power consumption in the larger sizes up to 20 percent. It is also stated by the maker that weight, floor area, and general space requirements are less than 10 percent of those required by other types of compressors. Drive may be by electricity, steam, or gas turbine.

The high efficiencies obtained are claimed to result from the use of rotor and stator blades based on modern aerodynamic theory. Each blade is in itself a small airfoil. Compression is produced in both the rotors and the stators. Each blade is specially shaped from root to tip and twisted so that its cross-section varies throughout its length in accordance with required aerodynamic theory. Each stage increases pressure about 20 percent, so that, for example, four stages will produce a compression ratio of approximately 2.07. The necessity for intercooling, however, makes it impracticable to produce a pressure ratio of more than about 7 to 1 in a single unit, so that if pressures higher than 100 psig. are needed, two units with intercooling between would ordinarily be employed.

2. Scoop Loader

KNOWN as the Scooter-Loader, a new scoop type loader capable of moving 8 cu. ft. or 1,200 lb. of loose material at speeds up to 15 m.p.h. has been introduced by Arrow Contractors Equipment Co., 2020 Walnut St., Chicago 12, Ill. The loader is small enough to work in a box car or restricted plant space in handling fertilizers and other loose chemicals. Drive is to the front wheels on which the weight of the machine and load are centered for greatest traction and stability. Caster type rear wheels enable the loader to turn in its own length of 6½ ft. Four forward speeds and one speed in reverse are provided, the unit being powered with a 9-hp. air-cooled engine. The loader is said to cost about one-half the price of front end loaders of but 400 to 600 lb. greater capacity.

3. Improved Fork Stacker

TEN MAJOR improvements in design have been made, it is claimed, in a new suspended fork model of its Transtacker by the Automatic Transporta-

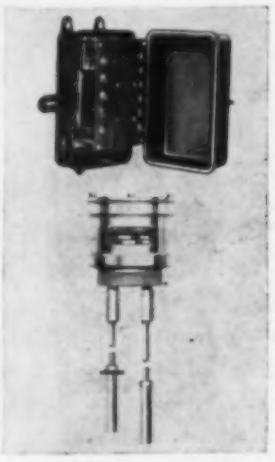
tion Co., 149 West 89th St., Chicago, Ill. In addition, the unit has been reduced in both cost and weight. The machine is of the motorized hand-truck type and incorporates among its special features an automatic tilt at carrying position which cannot be forgotten by the operator because it functions automatically. Other improvements are designed for more effective operation, durability, safety and economy. Road clearance has been raised 2 in. and controls have been improved for easier operation. Although the weight of the truck is only 3,400 lb., its capacity is 2,500 lb. for a 36-in. load, or 2,000 lb. for a 48-in. load. With an overall height of 79 in., the lifting height of the fork is 64 in.

4. Roller Conveyor Curve

MADE in 90- and 180-deg. units, the new Streamliner power-driven curve for roller conveyors is being offered by Harry J. Ferguson Co., 149 West Ave., Jenkintown, Pa. The unit employs 2-in. diameter rollers driven by means of a ¼-hp. motor through a reducer and chain drive. The single-phase motor is reversible for operation in either direction.

5. Through-Floor Conveyor

AN INCLINED floor-to-floor conveyor produced in belt widths from 8 to 24 in. is being offered by the Sage Equipment Co., 30 Essex St., Buffalo 13, N. Y. The conveyor is of slider-bed type construction and is provided with a power-driven tail feeder. It is furnished complete with a gear-head motor and 25 ft. of rubber-covered cord. As shipped, the conveyor is ready for installation, which takes only one to two hours.



6. Level Control

FOR GENERAL PURPOSES in the field of level control, particularly in chemical processing, Photoswitch, Inc., 77 Broadway, Cambridge 42, Mass., has introduced the new Type 10CB1 controller consisting of an electric relay operating from a probe circuit through a transformer and a rectifier. Only the stainless steel probe rods are located in the liquid itself. The unit is said to be able to control the level of practically all electrically conductive liquids. The probe circuit may be set at several different sensitivities so as to discriminate between a liquid and its foam, as in the manufacture of penicillin. This unit is the only floatless level control, according to the manufacturer, which contains no vacuum tubes and operates with low voltage in the probe circuit. The low-voltage probe circuit controls a power circuit which operates a relay to actuate signals, valves, or pumps. The output contacts can handle 2 amp. at 115 volts a.c., or 1 amp. at 230 volts a.c.

7. Oscillating Conveyor

DESIGNATED as Type PA, a new positive-action oscillating-trough conveyor has been announced by the Link Belt Co., Chicago 1, Ill. This conveyor, differing in construction from types previously built, is said to be suitable for the handling of a wide variety of materials in a horizontal path. The conveyor is provided with roller bearings and is driven by this company's Electrofluid drive. Standard trough widths range from 12 to 48 in., and single trough lengths up to 100 ft. can be obtained. For longer runs, two or more units may be arranged in series, one discharging into the other. This conveyor can also serve as a cooler, dryer or conditioning unit when jacketed, louvered, or otherwise constructed for the service intended. Dust-tight and gas-tight covers can be provided if desired.

The new conveyor is particularly recommended for conveying sharp, jagged, abrasive, wet, hot, or other difficult-to-handle materials. Advantages claimed include ability to handle materials without spillage, low maintenance under severe operating conditions, little trough wear, and easy installation.

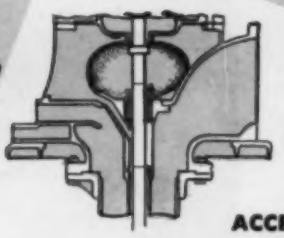
8. Drum Tongs

LIFTING of steel drums is facilitated by a new development of drum chime tongs now being manufactured by Downs Crane & Hoist Co., 540 West Vernon Ave., Los Angeles 37, Calif. The tongs, made for a heavy-duty service, can handle all drums, with or without heads, 18 in. to 24 in. in diameter. The lifting arms are self-equalizing, and both jaws have the same positive grip. Holding is said not to be affected by oily or greasy substances, and the drums are claimed not to be damaged in any manner. Drums are handled in an upright position and can be lifted out of a tier without moving or disturbing surrounding drums.

9. Mechanical Seal

FOR SEALING rotating high-pressure shafts against light hydrocarbons, the Durametallic Corp., Kalamazoo,

OPEN IMPELLERS . . . that eliminate overloading, sand-locking and costly stoppages . . . minimize wear . . . eliminate the need for sealing or wearing rings.



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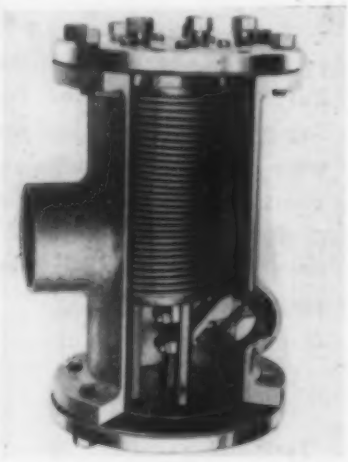
Mich., has introduced the new Type P.S. Dura Seal. This seal is suitable for pressures to 600 psi., and temperatures to 250 deg. F. No lubrication is required. It is claimed that the seal is completely non-leaking and that, since it rotates positively with the shaft, it cannot wear either the shaft or the sleeve. It can be installed in conventional stuffing boxes on new or old equipment and requires no special machining of the shaft, except to drill small holes for the locking set screws. The unit consists of a collar carried on the shaft which positively drives a spring-loaded hardened seal ring. A self-aligning, floating type sealing member of specially treated carbon is held stationary in the gland to bear against the rotating sealing ring. If desired, the gland may be cooled. An auxiliary stuffing box may be attached outside the gland, if needed. This is used only in case it is desired to vent vapors which might otherwise escape from the seal in event of irregular or abnormal operation.



10. Aneroid Manometer

As an addition to their regular line of aneroid manometers for measuring and controlling flow, liquid level, or specific gravity, the Taylor Instrument Cos., Rochester, N. Y., have announced a new model of Type 316 stainless steel. The housing and all internal parts coming in contact with corrosive media are made of stainless steel. Because corrosive fluids can be introduced directly into the manometer, no sealing fluids or purges are necessary. As in other mercuryless manometers made by this concern, the balancing agent is a torque tube which thus requires no stuffing box and eliminates wear on internal moving parts. The manometer is available in ranges of 20, 50, 100 and 200 in. of water differential, with a body pressure rating of 300 psi.

11. Kiln Boring Bar

The accompanying illustration shows a new water-cooled boring bar for removing deposits from rotary kilns, erected in the plant of its manufacturer, Allis-Chalmers Mfg. Co., Milwaukee, Wis., prior to shipment to a large industrial chemical firm. The device is intended for use in rotary kilns treating material which tends to build up on the refractories. An example is the nodulizing of certain ores. The 20-in. diameter bar is 40 ft. long and is mounted on a motor-driven carriage. It consists of a large water-cooled tube, to the end of which is bolted a cutting edge. This bar is slowly inserted into the rotating kiln and cuts off the fused materials adhering to the lining. If not removed, such an accumulation of material would eventually build up and render the kiln inoperative.

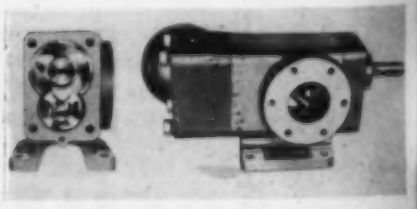
12. Heatless Dryer

For the drying of heat-sensitive materials, such as penicillin and other anti-biotics at room temperature, Oscar Fisher Co., 109 Worth St., New York 13, N. Y., has introduced a dryer known as the Anhydrator which instead of heat employs recirculated filtered air of extremely low humidity. The unit was first employed in photography and medicine, followed by applications in the drying of anti-biotics. It is now being recommended also for a variety of other drugs, chemicals, foods, and textiles.

13. Pulp Press

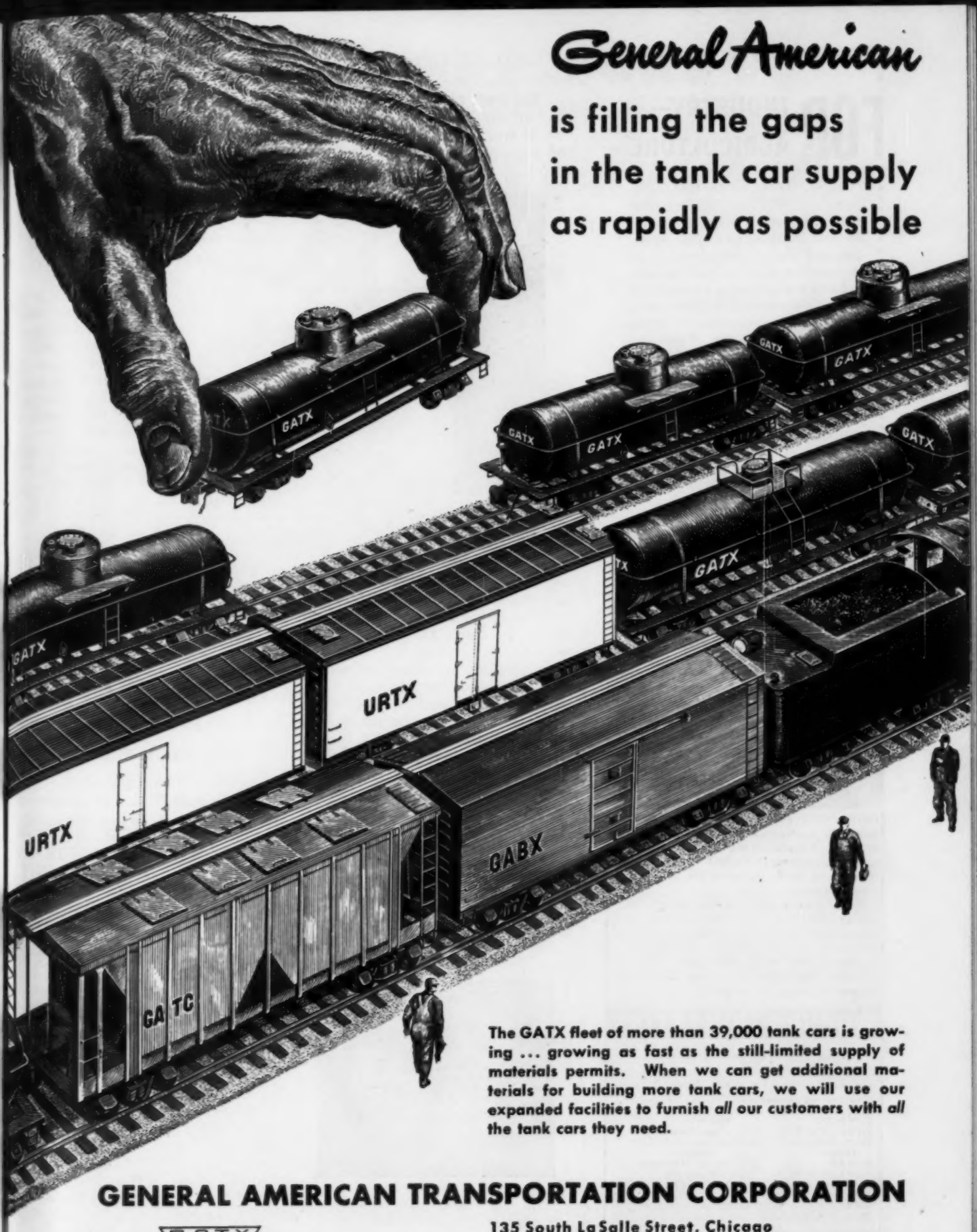
Recent improvements in the Zenith pulp press have been announced by the manufacturer, Jackson & Church Co., Saginaw, Mich. The press, which is of use in such industries as viscose, paper pulp, cornstarch, fish reduction, glue, agricultural waste and sugar beet processing, and others, is now equipped with a hydraulically operated discharge port pressure cone which provides constant pressure, plus variable opening at the pressed cake discharge port.

The movable cone is connected to a sliding ring which floats on hydraulic jacks. The jacks are powered by a separate power and control unit equipped with a pressure control valve and gage, separate from the press and located at any convenient point. It is only necessary for the operator to turn the control valve until the desired pressure is indicated. The hydraulic system then takes over and throttles the cake discharge until sufficient downward pressure is built up to overcome the hydraulic force. The port then automatically opens until a pressure balance is reached. It is claimed that this improvement gives a drier pressed cake, greater fuel savings when the pressed pulp is to be dried, and higher recovery of the expressed liquid.



14. Rotary Pump

Liquids with reasonable lubricating properties may be pumped continuously and without pulsation by means of a new helical rotor pump of unusual design announced recently by the Syntron Co., Homer City, Pa. The pump, which is of the positive displacement type, employs two helical rotors, one a driving rotor and the other an idler. These rotors force the liquid ahead in axial flow. Two sizes



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"Virginia" Zinc Sulfate (Monohydrate)—$ZnSO_4 \cdot H_2O$—has numerous industrial and agricultural applications. It is valued in the fine chemicals and pharmaceuticals fields, as an excellent base for zinc stearate and other zinc-bearing formulas. It is used in electroplating, in the paint trades, in the processing of rayon, and in the manufacture of glue and other adhesives. Its fine, uniform texture and ready solubility make it ideal for fertilizer, insecticide, fungicide mixtures, agricultural sprays and dusts. Immediate shipment in 100-pound bags and 400-pound barrels.

For descriptive literature on "Virginia" Zinc Sulfate, write VIRGINIA SMELTING COMPANY, Box 21, West Norfolk, Virginia.

VIRGINIA *Chemicals*

Established 1898

WEST NORFOLK • NEW YORK • BOSTON • DETROIT

50 years of service to industry

WHAT ARE FATTY ACIDS? WOBURN dependable PRODUCTS

FATTY ACIDS, until about 20 years ago, were generally considered unavoidable by-products. But, tremendous chemical developments and advancements in the last few years have made fatty acids indispensable to modern manufacturers.

Woburn has prepared a descriptive bulletin service describing many characteristics and applications of organic chemicals covering fatty acids and allied fields.

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WOBURN BULLETINS

WRITE today for bulletins desired—also for any special information concerning the use and application of organic chemicals to fill your specific requirements.

- Fatty Acids
- Fatty Acids for Soaps
- Woburn Conjugated Fatty Acids
- Wolin Oil
- Fatty Acids in the Textile Industry
- Alkyd Resin Formulas
- Isoline
- Isoline Varnish Formulas
- Seedine
- Alkyd Resins
- Bodying of Dehydrated Castor Oil
- The role of Oxidation in Drying Oils
- Solid 10, 12—Octadecadienoic Acid-1
- Conjulin Fatty Acids
- Conjulin Drying Oil

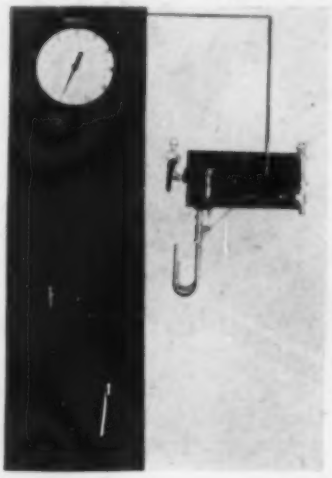
Prepared by

WOBURN CHEMICAL CORPORATION (N. J.)

1200 Harrison Avenue Harrison Post Office

KEARNY, N. J.

are available, one for 50 and the other for 75 gpm., at pressures up to 125 psi. The shaft of the driving rotor is mechanically sealed and is subjected only to the difference between suction and atmospheric pressures.



15. Stack Gas Analyzer

CONTINUOUS indicating and recording of stack gas conditions as a guide to more efficient combustion is the function of the new flue gas analyzer offered by Davis Emergency Equipment Co., 45 Halleck St., Newark 4, N. J. The analyzer indicates the completeness of the combustion and shows that maximum practical combustion is being obtained when the fuel-air ratio is adjusted to give the highest reading on the analyzer scale, without appreciable increase in stack temperature. The instrument is of the thermal conductivity type, employing a single stainless steel analysis cell for measuring the conductivity of the composite stack gases. Continuous flow through the cell is maintained by the stack differential pressure, without pumps or aspirators. The cell operates on a wet-gas basis, without the need for a chemical drying chain.

16. Bin Level Indicator

FOR USE on very small equipment, such as hoppers, spouts, chutes and conveyors, the Bin-Dicator Co., Detroit 15, Mich., has developed a new, smaller Bin-Dicator called the Bantam. This unit is only 5¾ in. over-all in diameter. Like the larger units, it is a diaphragm-operated switch in a sealed housing which can be mounted on the outside of solid-containing equipment for automatically starting and stopping filling and emptying equipment as the level of material reaches designated limits.

FOR MORE INFORMATION
See Reader Service
Coupon on pages 175-176

17. Temperature Controller

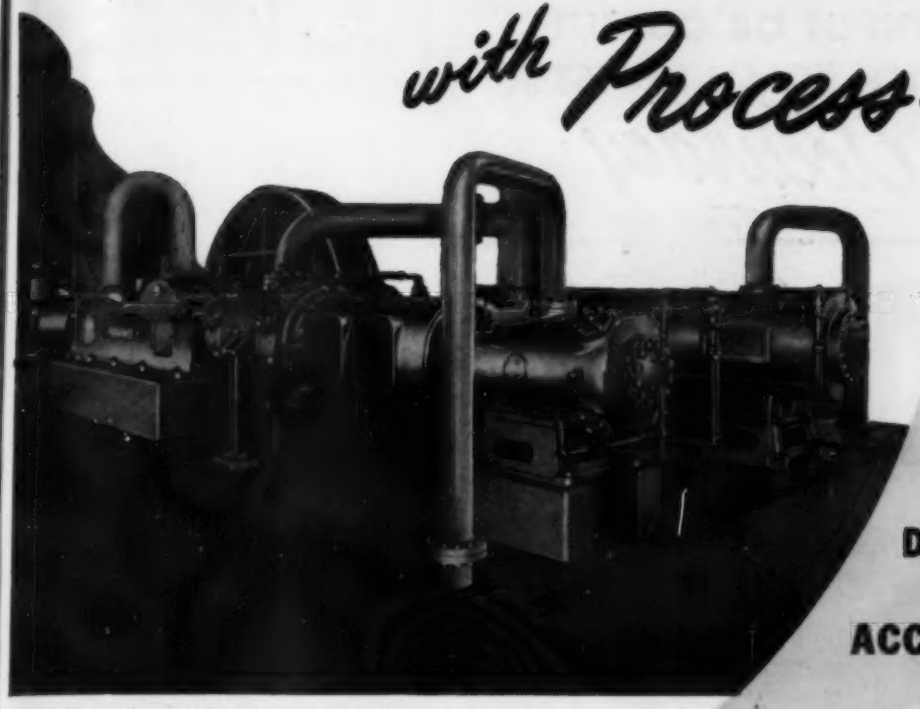
AN ON-OFF CONTROL employing a single electronic tube and an electrical resistance type bulb for temperature measurement is being offered currently by the Instrument Division of Thomas A. Edison, Inc., West Orange, N. J. The bulb may be located at a remote point and requires no thermal compensation. The instrument is non-indicating and may be used to cover the temperature range from minus 100 to 1,200 deg. F. Load capacity is 30 amp. at 115 volts, or 20 amp. at 230 volts.

18. Direct-Fired Heater

THERMAL EFFICIENCIES of 80 to 85 percent are claimed, when firing No. 3 fuel oil or gas, for the new Thermobloc direct-fired unit heater recently announced by the Thermobloc Division of Prat-Daniel Corp., East Port Chester, Conn. The unit delivers 550,000 Btu. per hour in heated air, without excessive velocity, and without the use of ducts. The floor space required is 30 in. in diameter, and the unit is completely automatic and requires no attendance. During the summer its air fan can be operated with-

PROCESS COMPRESSORS

with *Process-ability*



One of three 1200-hp, 3-stage, steam-driven gas compressors operating on high-pressure superheated steam against high back pressure in a chemical plant.

SUITABILITY

CONTROL-ABILITY

DURABILITY

DEPENDABILITY

ACCESSIBILITY

These are more than words! In a process plant, they represent values that cannot be measured in dollars first-cost, cubic-feet capacity, or horsepower of the compressor itself..., but, more important, they must be measured in terms of sustained production, quality of product, and safety in operating both the compressor and the process.

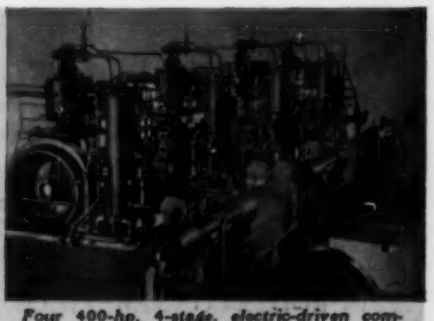
The best way to be sure a compressor has *Process-ability* is to select a manufacturer with years of actual engineering experience in building and applying compressors for all kinds of processes...for handling all sorts of gases...and for all ranges of pressures.

Ingersoll-Rand has that experience and can help you solve your compression problems.

81-1

Six process compressors ranging from 200 to 1000 hp in a Chemical Plant. Each handles different gases at different pressures.

2500-hp, 7-Stage, electric-driven gas compressor operating at 15,000-psi discharge pressure in a synthetic-ammonia process.

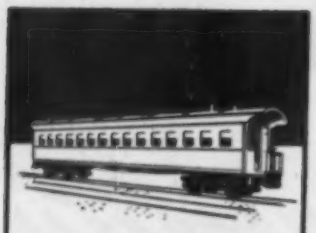


Four 400-hp, 4-stage, electric-driven compressors discharging at 4000-psi pressure. (Four 100-psi compressors at lower right.)

Ingersoll-Rand

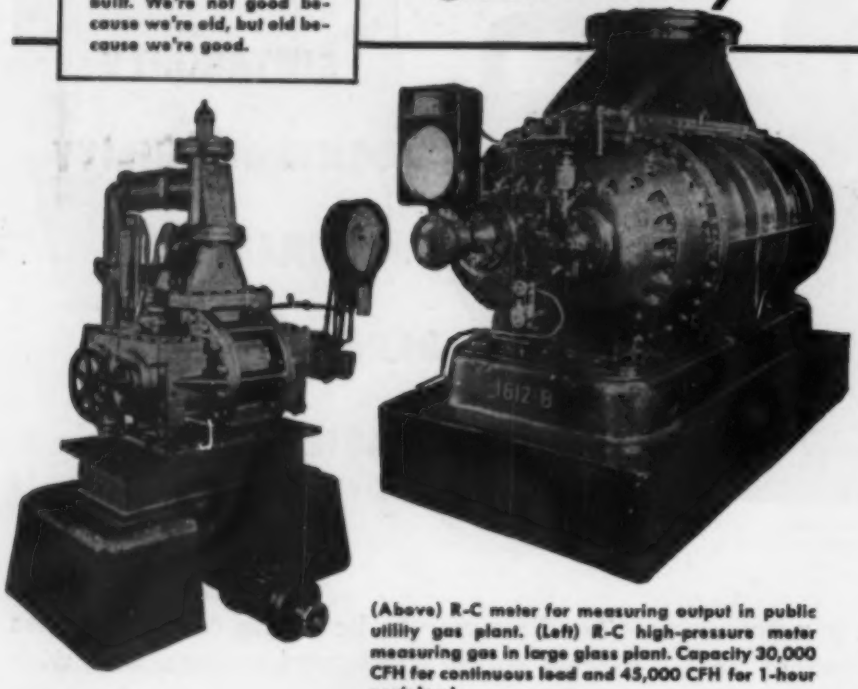
11 Broadway, New York 4, N. Y.

AIR TOOLS · ROCK DRILLS
COMPRESSORS · TURBO BLOWERS
CENTRIFUGAL PUMPS · CONDENSERS
OIL AND GAS ENGINES



George M. Pullman's first sleeping car went into service in 1859, five years after the first Roots Blower was built. We're not good because we're old, but old because we're good.

Measure INPUT OR OUTPUT WITH "CASH REGISTER" Accuracy



(Above) R-C meter for measuring output in public utility gas plant. (Left) R-C high-pressure meter measuring gas in large glass plant. Capacity 30,000 CFH for continuous load and 45,000 CFH for 1-hour peak load.

Wherever gas needs to be measured . . . for buying, selling or processing . . . you get unfailing accuracy from R-C Positive Displacement Meters. The reasons are:

1. Accuracy is not affected by variations in specific gravity, rate of flow, pulsation, moisture or impurities.
2. Accuracy does not depend on uncontrollable factors.
3. Accuracy is not subject to adjustment of meter or recorder by operators.
4. Accuracy is not affected by reasonable overloads.
5. Accuracy is permanent because measuring chambers are surrounded by precision-machined, cast-iron surfaces.

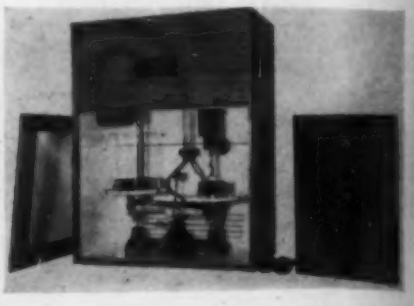
The wide use of R-C Meters by public utilities, producers, industrial users and processors is the best evidence of satisfactory performance. For details, ask for Bulletin 40-B-14 or write us about your specific problem.

ROOTS-CONNERSVILLE BLOWER CORPORATION
809 Illinois Avenue, Connersville, Indiana

ROOTS-CONNERSVILLE
ROTARY CENTRIFUGAL
BLOWER BUILDERS R-C SINCE 1854
BLOWERS · EXHAUSTERS · BOOSTERS · LIQUID AND VACUUM PUMPS · METERS · INERT GAS GENERATORS
ONE OF THE DRESSER INDUSTRIES

FOR MORE INFORMATION
See Reader Service Coupon on pages 175-176

out the burner, for circulating cool air from the floor to the normal working level.



19. Automatic Liquid Balance

DESIGNED both for the primary calibration of continuous-reading flow meters, and for laboratory and pilot plant use where extreme accuracy of flow measurement is required, the Engineering Research & Development Co., Hinsdale, Ill., has introduced an automatic liquid balance which accomplishes flow measurement of any liquid automatically by weight. The device operates without interruption of the flow and eliminates the possibility of human error. Manual operation of valves, etc., is completely unnecessary. The device measures the time required for a given quantity of liquid flow by balancing against a calibrated weight. Other advantages claimed include elimination of liquid wastage, elimination of carryover when liquids are changed and reduction of fire hazard with flammable liquids. Although originally intended for measuring fuel flow to internal combustion engines, the new liquid balance is suitable also for oils, hydrocarbons, acid, and a variety of other liquids.

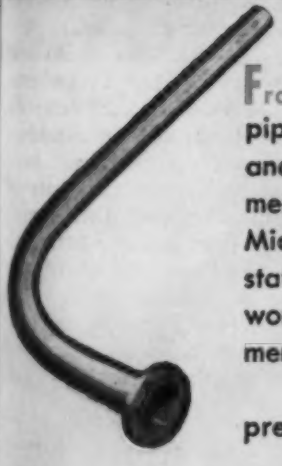
20. Ball Type Valve

NO LUBRICATION is required, it is claimed, in a new ball-type quarter-turn valve for high and medium pressure service in petroleum and chemical industries, which is being offered by the Kerotest Mfg. Co., Pittsburgh 22, Pa. The valve element is a spherical ball mounted on vertical trunnions which is sealed by seats flexibly mounted in such a way as to form a perfect ball-and-socket joint with the ball, and separate the fluid passage

PIPING . . . . . .

EXACTLY AS YOU NEED IT!

PREFABRICATED by MIDWEST



From a simple bend to prefabricated piping complete for the most elaborate and complex job . . . Midwest Piping will meet your requirements exactly. The four Midwest Plants, strategically located, are staffed by experienced piping specialists working with the most advanced equipment.

Midwest modern methods assure prefabricated piping that meets the most difficult conditions . . . is accurate in dimension and alignment . . . carefully shop tested . . . heat treated and stress relieved when necessary . . . thoroughly cleaned and inspected. Midwest Piping is delivered to the job in a series of sub-assemblies that minimize erection time, trouble and cost. You will find it to your advantage to get in touch with Midwest whenever you need piping.

MIDWEST PIPING & SUPPLY COMPANY, Inc.

Main Office: 1450 South Second St., St. Louis 4, Mo.

Plants: St. Louis, Passaic, Los Angeles and South Boston
Sales Offices: New York 7—30 Church St. • Chicago 3—79 West Monroe St.
Los Angeles 33—520 Anderson St. • Houston 2—229 Shell Bldg.
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4 PLANTS ARE BETTER THAN 1

MIDWEST PIPING IS *BETTER* PIPING

A good strainer protects your equipment and pipeline.

These little Yarway "guardians of the pipelines" have literally taken industry by storm. In the few years since their introduction, hundreds of thousands have been bought . . . are daily giving top satisfaction in a variety of services.

HERE ARE SOME OF THE REASONS:

- SCREEN—a high-grade woven monel wire basket that catches solids—lets condensate, oil or other fluids flow freely. Perforated screens if desired.
- SCREEN CAP—easily removed. Cap and screen come out together. Screen automatically aligns when replaced. Machined face and spark-plug-type gasket provide tight joint.
- BODY—rugged iron or steel, cadmium-plated for protection against corrosion and for better appearance.
- SIX SIZES—½" to 2" for pressures up to 600 lbs.
- AVAILABILITY—stocked and sold by 150 Mill Supply Houses. Reasonably priced.
- See your local dealer or write for Bulletin S-201.

YARNALL-WARING COMPANY
137 Mermaid Avenue Philadelphia 18, Pa.

YARWAY STRAINERS
"Police the Pipelines"

from the body of the valve at all times. The valve is said to be uniformly easy to operate under high pressure, and the wiping action of the seals is claimed to eliminate sediment collection and, in fact, to exert a burnishing action on the ball and seat surfaces which is claimed constantly to improve the valve action. The valve is suitable for temperatures up to 450 deg. F., and pressures to 4,000 psi. Working parts are of 12-14 chrome heat-treated stainless steel, suitable for many corrosive services. The valve is produced in sizes ranging from 2 to 4 in.

21. Bronze Threadless Fitting

FOLLOWING introduction of its novel line of threadless malleable iron fittings (*Chem. Eng.*, March 1948, p. 143), Stanley G. Flagg & Co., 1421 Chestnut St., Philadelphia 2, Pa., has introduced a line of bronze and brass fittings applying the same principle. These are obtainable in both iron pipe and tubing sizes. They are applied to I.P.S. brass or copper base alloy tubing or pipe by brazing to produce a one-piece system suitable for 150 psi. working steam pressures at 450 deg. F., or 300 psi. non-shock cold water, oil or gas service. The fittings have the same wall thickness and dimensions as standard bronze fittings and can be used with thin-wall pipe or tubing since the full strength of the pipe wall is utilized, there being no loss of wall thickness due to threading. The fittings are particularly suitable for use in confined spaces where it is difficult to use a pipe wrench. Installation is comparatively easy, and any suitable capillary-action alloy can be used.

22. Floc Producer

WATER TREATMENT plants employing aluminum hydroxide floc for the clarification of water now have available a new method of floc production which, according to the manufacturer, offers marked advantages over the use of alum. This method employs the principle of electrolytic dissolution of

We pioneered yesterday to help your budget today!

Greatly enlarged photograph of IngAclad machine cutting

ENGINEERING B-W PRODUCTION

Twenty years ago when Ingersoll perfected IngAclad, a few brave souls saw its economical advantages. They proved their confidence by ordering test installations. These went chiefly into the various process industries.

Today, IngAclad Stainless-Clad Steel is accepted everywhere with the same confidence Ingersoll solid stainless steel is accepted.

Where budgets are tight—and where stainless service is required only for the contact side—specify IngAclad Stainless-Clad Steel. Available in sheets 18 to 8 gauge, and in plates 3/16" to 1/4" inclusive.

Profit by the pioneering we did yesterday to help your budget today. INGERSOLL Steel Division, Borg-Warner Corporation, 310 South Michigan Avenue, Chicago 4, Illinois. Plants: Chicago, Illinois; New Castle, Indiana; Kalamazoo, Michigan.

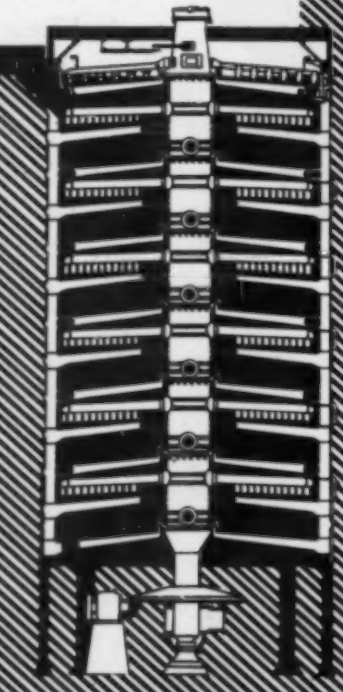
Thermal Efficiency Speaks for Itself!

Nichols Herreshoff and Bethlehem Wedge Multiple Hearth Furnaces

Proof is in performance. In hundreds of industrial plants all over the world Nichols Herreshoff and Bethlehem Wedge Multiple Hearth Furnaces are demonstrating a high degree of thermal efficiency. Heat energy is employed to the fullest extent. Combustion air can be returned to hearths for re-use, sealed feeds and shaft seals prevent escape of gases or infiltration of air.

Nichols Herreshoff and Bethlehem Wedge Multiple Hearth Furnaces are available in sizes ranging from 18" I.D. to 25' 0" O.D. with from one to sixteen hearths.

NICHOLS
ENGINEERING & RESEARCH CORP.
60 Wall Tower — New York 5, N. Y.
***In Canada:* 1477 Sherbrooke Street West, Montreal**



THERMAL ENGINEERING SPECIALISTS

FOR MORE INFORMATION
See Reader Service Coupon on pages 175-176

aluminum in water to produce a concentrated aluminum hydroxide floc. The equipment provided applies a variable low-voltage direct current to an assembly of alternate aluminum and stainless steel plates. The plate assembly is inclosed in a stainless steel tank through which a controlled flow of water is maintained. The aluminum plates serve as the anode and free aluminum particles are produced which immediately react with the water flowing around the plates to form the floc. This floc rises to the top of the tank and is carried off by means of a discharge trough and pipe to a point where it is introduced into the raw water stream to be treated.

The equipment is designed for ready replacement of the aluminum plates as they are consumed. It is claimed that only 68 lb. of aluminum will do the work formerly requiring nearly three-quarters of a ton of other coagulents. It is further claimed that the equipment works efficiently at any pH or temperature conditions normally found in water treatment, that no pre-conditioning is necessary for good coagulation and that no acid condition results, requiring corrective chemicals after treatment.

Equipment Briefs

23. For on-off control of temperature, pressure, flow, liquid level or humidity, Taylor Instrument Cos., Rochester, N. Y., have introduced a new electric contact controller of either the indicating or recording type, featuring a new friction-free contact action requiring minimum contact pressure. Closing of the contact completes a circuit through a sensitive, hermetically sealed relay which operates on a very small current and thus requires a minimum of contact pressure. The unit is designed to complete the circuit through only one set of contacts, rather than the usual two or more sets, and employs a low-voltage, 24-volt circuit to eliminate possibility of short circuiting.

24. To improve industrial insect control, the West Disinfecting Co., 42-16 West St., Long Island City 1, N. Y., has introduced an improved insecticide atomizer designed to insure proper application of the present high

New Ideas

...for speeding production, improving quality and cutting cost with REEVES Speed Control

The new ideas for increasing production efficiency, shown at right, are only three of thousands such improvements made possible by REEVES Speed Control.

Throughout industry—wherever there is need for variable speed control—REEVES opens the way to faster output, higher quality and lower cost.

REEVES Variable Speed Drives provide any driven machine with instant, accurate speed adjustability . . . *deliver exactly the right speed for every operation and every operator, under every changing condition.* Stops and slowdowns are eliminated . . . waste of material and manpower are held to a minimum . . . and production is maintained at the fastest tempo consistent with high, uniform quality.

REEVES Speed Control is easily installed on machines already in service, and is now standard equipment on over 2,100 different makes of modern production machines. Three basic REEVES units are offered in the widest selection of designs, sizes, capacities and speed ratios—with manual, push-button or completely automatic controls.

Install REEVES Speed Control on your machines now—and always specify REEVES-equipped machines when you buy new equipment. Write for comprehensive 114-page catalog CE9-450A.

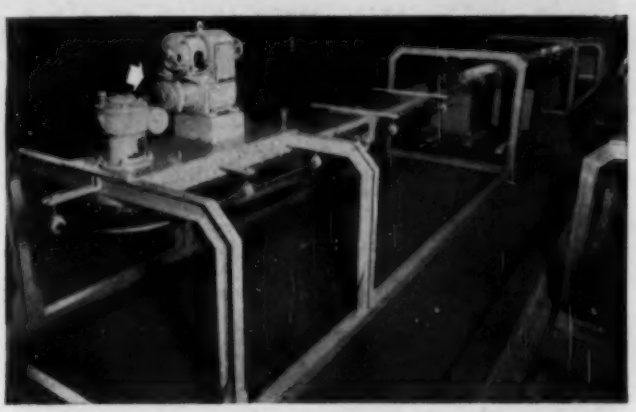
REEVES PULLEY COMPANY • COLUMBUS, INDIANA

Recognized Leader in the Specialized Field of Speed Control Engineering

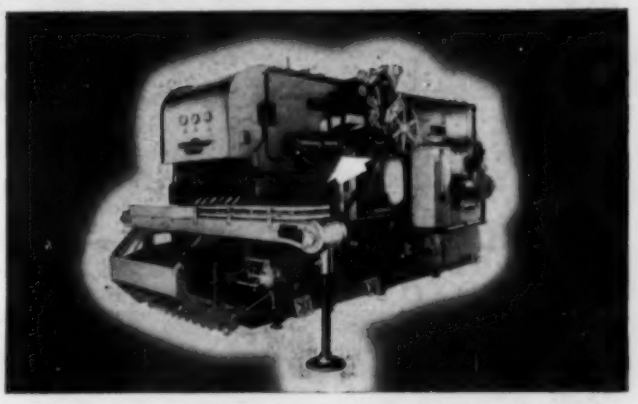
ACCURATE • VARIABLE

Reeves Speed Control

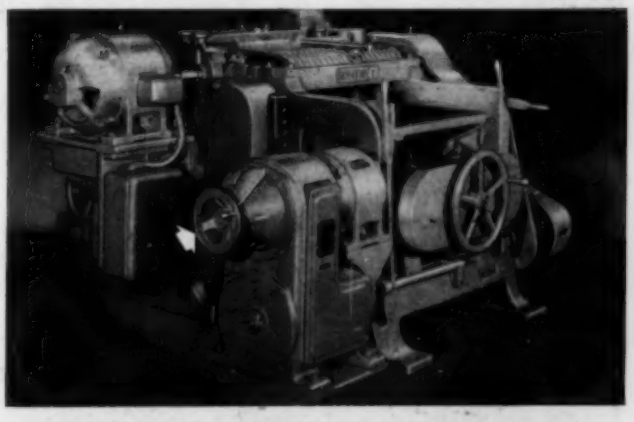
GIVES THE RIGHT SPEED FOR EVERY JOB!



Applied to this automatic conveyor for electroplating, REEVES Motodrive delivers any desired chain speed for any type of plating work being done . . . permits maximum production and uniform plating for a wide variety of products. Conveyor is manufactured by Lasalco, Inc., St. Louis.

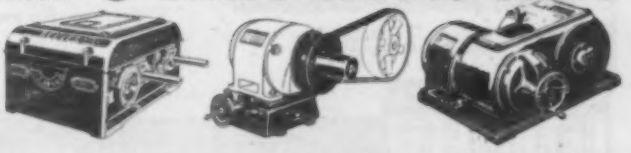


REEVES Vari-Speed Motor Pulley on this "Viking" Bottle Cleaner—manufactured by Barry-Wehmiller Machinery Co., St. Louis—provides exact cleaning time needed for different sizes of bottles, and synchronizes the cleaner with various other equipment, such as fillers and cappers.



On this Double Surface Wood Planer, manufactured by Baxter D. Whitney & Sons, Inc., Winchendon, Mass., a REEVES Motodrive regulates rate of feed to compensate for variances in hardness of the wood and depth of the cut.

THE 3 BASIC REEVES UNITS



VARIABLE SPEED TRANSMISSION for providing infinite, accurate speed flexibility over a wide range—2:1 to 16:1. Sizes—fractional to 87 hp.

VARI-SPEED MOTOR PULLEY provides an instantly variable speed drive within 4:1 ratio for any constant speed motor. Sizes to 15 hp.

MOTODRIVE combines motor, speed varying mechanism and reduction gears in single unit. Speed variations 2:1 to 6:1 inclusive. Sizes to 15 hp.

SOLID STAINLESS AGITATED MIXER

LEADER BUILDS
TANKS — KETTLES — FRACTIONATING COLUMNS
HEAT EXCHANGERS and SPECIAL EQUIPMENT
OF
STEEL—STAINLESS STEEL—NICKEL—MONEL
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LEADER IRON WORKS, INC.
2200 N. JASPER DECATUR, ILLINOIS

GAS! ALARM! A HAZARD AVOIDED!

A four point Davis Continuous Sampling and Recording Combustible Gas Alarm System

DAVIS REMOTE HEAD COMBUSTIBLE GAS ALARM SYSTEM measures flammable gases and/or vapor air concentrations in terms of their explosibility.

Analyzer Head located in area being sampled indicates the gas and vapor hazards under actual temperature conditions. Changes are communicated to—

Control Cabinet in gas free area. When concentrations have reached the alarm point:

1. Red "bull's-eye" shows area causing the alarm
2. Alarm bell in cabinet rings
3. External audible signal sounds in area causing the alarm

For complete technical details, write for Bulletin 1116-F.

INSTRUMENT DAVIS DIVISION

DAVIS EMERGENCY EQUIPMENT CO., INC.
60 Halleck Street, Newark 4, N. J.

efficiency insecticides. This device produces a dense fog of "dry" mist consisting of droplets about 8 microns in diameter. It is operated on air, steam, or carbon dioxide pressure, and use ten atomizing nozzles to dispense the insecticide into all strata of a room.

25. Roofs that will last more than 100 years can be made, it is claimed, with a new type of Monel metal sheet for roofing purposes, offered by the International Nickel Co., 67 Wall St., New York 5, N. Y. The new sheet is softer in temper, lending itself more readily to various bending, forming, sealing and soldering operations than sheet formerly available for this purpose. This roofing is said to be particularly suited for industrial applications in corrosive atmospheres.

26. Suitable for a variety of mechanical uses, as well as for color-coded fluid lines in process plants, a new color-armored tubing has been announced by Samuel Moore & Co., Mantua, Ohio. Known as Rub-Bub Color Armored Tubing, this product is electric welded steel tube covered with a $\frac{32}{32}$-in. coating of plastic color armor extruded and shrunk on to the tube. The tubing is available in six standard colors, including green, yellow, red, brown, blue and gray.

27. Ease of replacement as compared with other types is a feature of the new pulley lagging offered by W. H. Harrison & Son, 759 West Locust St., York, Pa. The lagging can be installed readily without removing the pulley from the machine. It consists of $\frac{1}{4}$-in. thick tire tread rubber applied in strips of suitable size, and is furnished by the manufacturer with cement and built-in fasteners.

28. Made of a material known as Kralite (a blend of synthetic rubber and thermoplastic resins), a new corrosion-proof plastic pipe is being offered to chemical manufacturers by the United States Rubber Co., New York, N. Y. The pipe is available in rigid and semi-rigid forms, in sizes ranging from $\frac{1}{4}$ to 2 in. O.D. It may be bent to various radii and threaded for fittings. No metal or fabric reinforcement is used in construction.

29. For production of small amounts of demineralized water for laboratory use, the Permutit Co., 330 West 42nd St., New York 18, N. Y., has introduced a new laboratory demineralizer with a capacity of 10 to 12 gal. per hr. The device is readily regenerated when exhausted at a cost of about 20 cents.

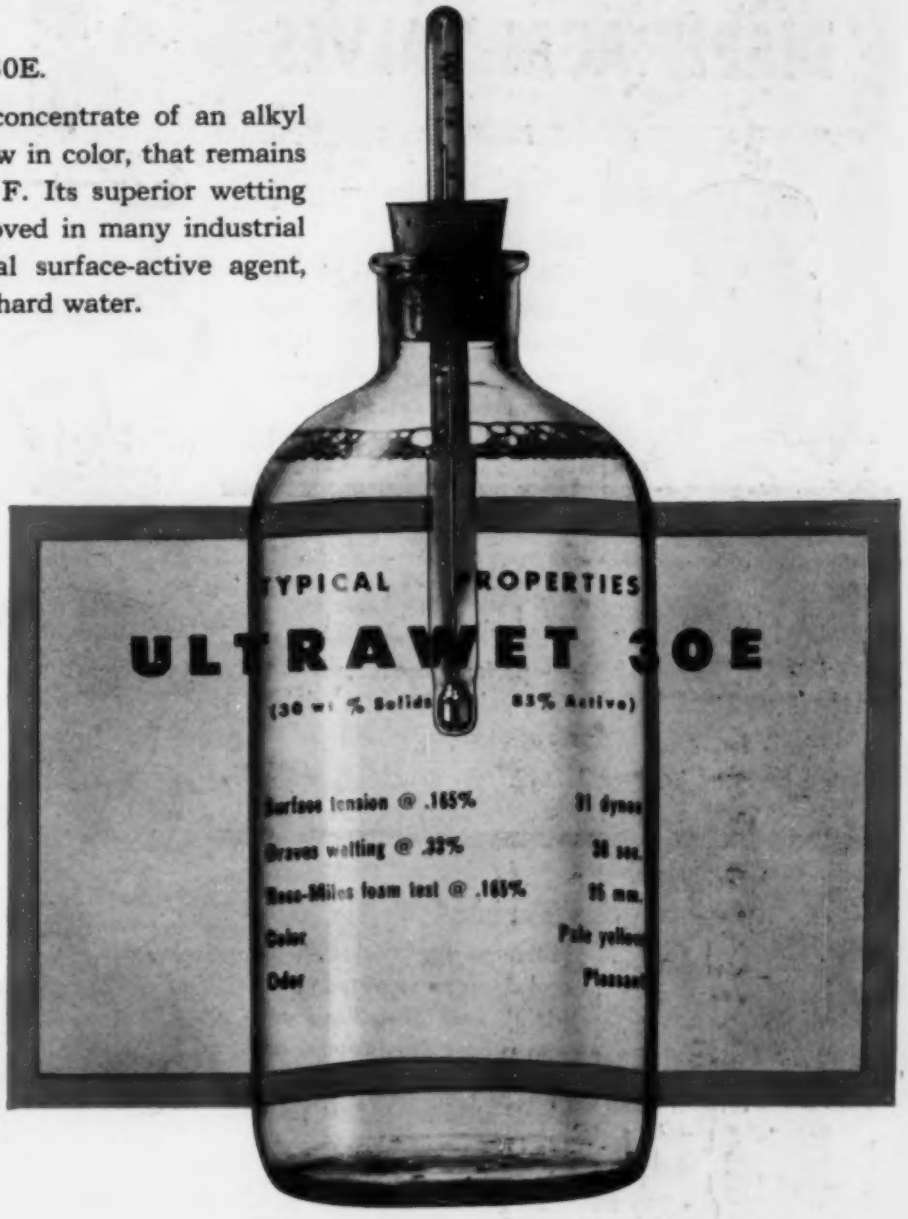
ATLANTIC PETROLEUM CHEMICALS

ULTRAWET 30E

NEED A WETTING AGENT IN A CONCENTRATED WATER SOLUTION?

Try Atlantic's Ultrawet 30E.

Here is a 30 per cent concentrate of an alkyl aryl sulfonate, pale yellow in color, that remains crystal clear above 70° F. Its superior wetting properties have been proved in many industrial processes. It is a neutral surface-active agent, stable in acid, alkali and hard water.


TYPICAL PROPERTIES
ULTRAWET 30E
(30 wt % Solids 83% Active)
Surface tension @ .165% 31 dynes
Draves wetting @ .33% 38 sec.
Ross-Miles foam test @ .165% 95 mm.
Color Pale yellow
Odor Pleasant

Ultrawet 30E is useful—and economical—as a wetting agent in textile, paper, leather and in many other industrial wet processes. It is especially effective for solubilizing and coupling and in emulsion-breaking applications.

It is another product of Atlantic Research—and of more than 10 years' experience in making detergents and wetting agents.

For samples, further information and quotations, write or wire

THE ATLANTIC REFINING COMPANY

Chemical Products Division

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If you're interested in valves that will give you any or all of these operating advantages then you'll be interested in

NON-CONTAMINATING

MINIMUM MAINTENANCE

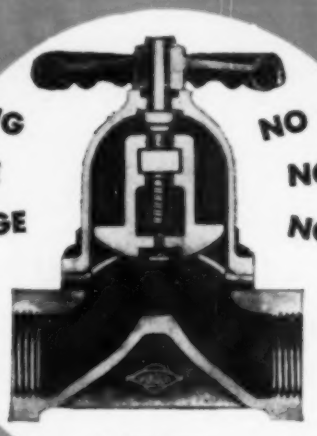
NO VALVE STEM LEAKAGE

NO CORROSION

NO CLOGGING

NO SEEPAGE

GRINNELL - SAUNDERS DIAPHRAGM VALVES

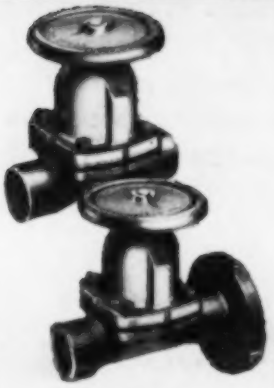


Valve Open

Valve Closed

FOR CHEMICALS

Stair less Steel valves with special diaphragms are handling satisfactorily such corrosive chemicals as phosphoric, acetic and chromic acids.



FOR BEVERAGES

Bronze valves with socket ends (left) and with hose threaded end (right), both with special white rubber diaphragms, are stopping leaks and cutting maintenance to the bone in breweries handling millions of barrels of beer.

FOR PULP and PAPER

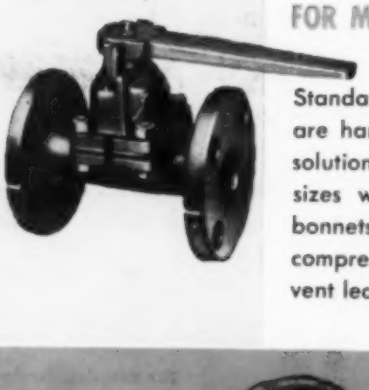
Rubber lined valves are setting new performance records handling pulp, alum and sulphuric acids in paper mills.

FOR TEXTILE PLANTS

Aluminum body valves with rising stems have won enthusiastic approval in bleacheries handling hydrogen peroxide and other chemicals.

FOR FOODS

Piston-operated valves (left) and air motor operated valves (right), both glass lined and with proper diaphragms, are providing remote control in plants handling sodium chloride, sodium hydroxide, sulphuric acid and fruit juices.



FOR MINES

Standard rubber-lined valves are handling highly abrasive solutions and slurries. Small sizes with quick-operating bonnets are widely used on compressed air lines to prevent leakage.

Grinnell-Saunders Diaphragm Valves may eliminate valve troubles and cut valve maintenance on your pipe lines. Available in any combination of valve bodies and linings, diaphragms and operating mechanisms. State your requirements or ask for Catalog 2-S on "Grinnell-Saunders Diaphragm Valves". Grinnell Company, Inc., Providence 1, R. I. Branch warehouses in principal cities.

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MANUFACTURERS' PUBLICATIONS

See also pages 334-348

101. **Cooling Coils.** McQuay, Inc., Minneapolis, Minn.—Catalog No. 400. 42-page booklet illustrating and describing the non-ferrous extended surface cooling coils made by this company. Featured are the plate type ripple-fins, and other

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construction details. Includes information on direct-expansion coils, water-cooling coils, and cleanable water-cooling coils. Tables of dimensions are given as well as selection data and other engineering information. Contains many tables of wet and dry bulb temperatures, etc. Also a 46-page data bulletin which contains 24 pages of rating tables for different conditions.

102. Heaters. The Brown Fintube Co., Elyria, Ohio—Bulletin 482. 8-page illustrated booklet describing the tank suction heaters and line heaters made by this company. Features of construction are shown in cut-away views. Dimension and capacity tables are included.

103. Steam Specialties. Sarco Co. Inc., New York, N. Y.—Technical Bulletin No. 2 contains 8 pages describing the use of Sarco equipment on steam-heated dry-cylinders.

104. Chemicals. American Cyanamid Co., New York, N. Y.—40-page, well-indexed booklet describing the product and services of this company. Includes information on the various divisions of the company and the products manufactured by each.

105. Equipment. Allis-Chalmers Mfg. Co., Milwaukee, Wis.—32-page annual review illustrating and describing the application of this company's equipment in a wide variety of industries.

106. Pumps. DeLaval Steam Turbine Co., Trenton, N. J.—28-page bulletin No. 33-29 illustrates and describes the complete line of single-stage centrifugal pumps made by this company. Cut-away views show features of construction, several pages of tables give capacity data for the different sizes and models.

107. Instruments. Bailey Meter Co., Cleveland, Ohio—40-page booklet No. 301-B, illustrates and describes the flow meters for steam, liquid, and gases made by this company. The different elements making up the complete flow meter are illustrated in detail.

108. Ion Exchange. The Dorr Co., New York, N. Y.—Bulletin 4081. 24-page booklet illustrating and describing the deionization systems available from this company. Includes a section on theory of iron exchange. Includes multi-color diagrams for explaining the process.

109. Chemicals. Hercules Powder Co., Wilmington, Del.—No. 18, "Hercules Chemist" describes the new rosin chemical abitol (hydroabietyl alcohol). Properties of abitol are tabulated. The booklet also includes data on ethyl cellulose lacquers, and other products made by this company.

110. Pumps. Worthington Pump Co., Worthington Pump & Machinery Corp., Harrison, N. J.—Bulletin W-305B1. 12-page booklet illustrating and describing the Types CN and CNE single-stage centrifugal pumps made by this company. Detailed drawings show features of construction. Contains rating curves and selection data.

111. Rubber Compounding Resins. Synvar Corp., Wilmington, Del.—16 loose-leaf pages describing this company's rubber compounding resins for compounding with Buna N and Buna S type rubbers.

112. Instruments. Sperry Products, Inc., Hoboken, N. J.—Bulletin 3001. 4-page folder describing the Supersonic Reflectoscope for metallurgical testing.

113. Pumps. Ampco Metal Inc. Milwaukee, Wis.—Bulletin 85. 4-page leaflet describing the corrosion resistant aluminum bronze centrifugal pumps made by this company. Details of construction, together with performance curves are illustrated.

114. Electric Motors. Allis-Chalmers Mfg. Co., Milwaukee, Wis.—24-page bulletin No. 05, B6133A. Illustrates and

(Continued on page 334)

These are good for items in this issue only and must be returned by November 30, 1948

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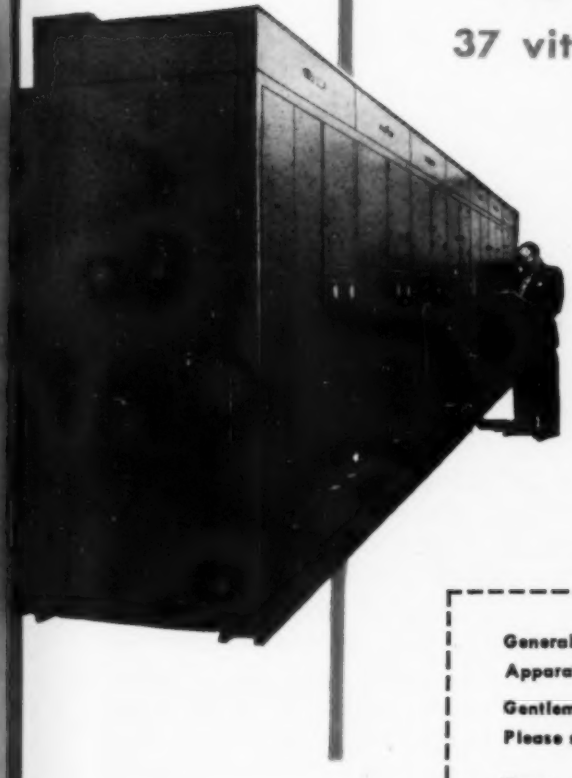
37 vital operations in this rubber plant



Protection of this plasticator is just one of the vital jobs done by Limitamp starters at the Fisk Tire Plant of the U.S. Rubber Company at Chicopee Falls, Massachusetts. Over a period of four years, more than thirty-seven of these units have been installed in the Fisk Plant to operate generators, mills, Banburys, plasticators—and Fisk plans to add more.

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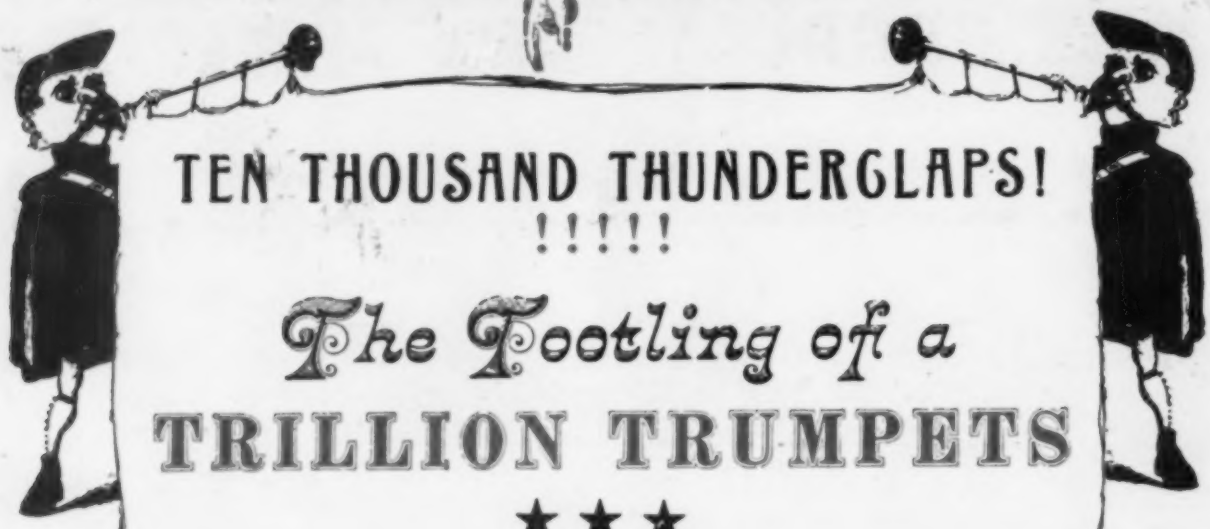

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NEW PRODUCTS AND MATERIALS

Richard W. Porter, ASSISTANT EDITOR

Wheat kernel showing egg plugs of the granary weevil stained with acid fuchsin.

51. Bug Detector

It is now possible to readily determine the percentage of hidden weevil infestation in grain. By soaking grain samples for a few minutes in a dye containing acid fuchsin followed by washing the grain, it was found by entomologists of the United States Department of Agriculture, that small cherry-red dots appear where weevils had laid eggs in the kernels. These dots are not present on grain that is free of weevils. Female weevils deposit their eggs in small punctures which they gnaw on the surface of the kernel and then carefully plug the hole with a jelly-like material. When hardened the plug seals the hole and the grain looks perfect from the outside. It is this plug which takes up the color of the stain. By means of this method of detecting stain, it should be possible to cut down the tremendous losses now experienced in grain storage.

52. Cathodic Corrosion Protection

Having been thoroughly tested in the laboratory and field, a new magnesium ribbon anode has been announced by the Dow Chemical Co., Midland, Mich., for use in protecting buried metal structures from corrosion by means of cathodic protection. Known as the Galvo-Line, this magnesium ribbon anode is designed for use primarily in high resistivity soils where cast anodes may not be practical because of their low current output under such conditions. Magnesium ribbon provides faster, simpler and less expensive methods of installation and it is claimed to reduce current requirement to a minimum by offering more uniform distribution and better utilization of current from the anode. This new product has a cross-section of $\frac{3}{8}$ in. x $\frac{3}{4}$ in. and contains a centrally located core of iron wire to facilitate the making of permanent electrical connections. It is claimed to supply from 3 to 7 times as much current per pound of magnesium installed as does a conventional cast anode. Anode ribbon is wound and stored on reels, and is available in standard lengths of 1,000, 2,000 and 5,000 ft.

53. Thickened Fuel

Application of thickened liquid fuel for use as a solid fuel igniter has been announced by the Esso Standard Oil Co., 15 West 51st St., New York 19, N. Y. Developed during the war for flame throwers and incendiary bombs, this new industrial product consists of thickened diesel oil, and will fire stokers and industrial boilers to a full operating steam pressure in 30 min. compared with 8 hr. often required by wood and coal kindling. Reduction of the time required for a full head of steam should eliminate the need for standby emergency fires.

Employing an aluminum soap, the semi-fluid, jelly-like fuel igniter can be applied in nests along the boiler grate. The thickened fuel burns slowly and with sufficient intensity to fire the coal. Tests show that only 5 gal. of the product were needed to fire boilers capable of producing up to 500,000 lb. of steam per hour.

54. Polystyrene Adhesive

Now available in commercial quantities from the chemical division of Koppers Co., Inc., Pittsburgh 19, Pa., is a new adhesive for bonding poystyrene. This new adhesive, a polystyrene solvent, can be used to bond polystyrene either to other pieces of polystyrene or to other solid materials. When bonds are made with this adhesive one joint element must be polystyrene, while the other element may be paper, cardboard, fabric, glass, rubber or certain other plastics. The manufacturer describes the outstanding features of this new adhesive as follows: It has quick initial set, assemblies may be carefully set down or removed from clamps in less than 5 min. after the adhesive is applied. Permanent set with maximum bond strength develops within a few days after application. In dry assembly the new adhesive can be applied with a small brush or eye-dropper, since it will flow between and bond matching joint surfaces. When applied in wet assembly by wiping, dipping or brushing, the relatively slow evaporation rate is advantageous.

When properly applied, clear, bubble-free bonds of good strength are obtained. It can be used for filling the gap between poorly matched joint sur-

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FOR MORE INFORMATION
See Reader Service Coupon on pages 175-176

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Some Good Magnet Advice!

Don't fall for any "cure all" permanent magnet to solve your magnetic separation problems.

The old medicine man had a cure all for every ailment and many a gullible sucker fell for this sales technique and found the stuff he bought failed to produce results. So — don't be fooled by propaganda that permanent magnets are the solution to *ALL* your tramp iron troubles.

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If you want consistent powerful and continuous magnetic strength for all kinds of magnetic separation, be smart, buy ELECTRICALLY energized magnets, magnets with guts. Don't buy a magnet that must be energized from an electric magnet. Buy the electric magnet in the first place.

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faces by mixing two parts of the adhesive with not more than one part of polystyrene. The mixture is then used as a cement. Although it is a polystyrene solvent, its solvent power is controlled so that etching is minimized and molding stresses in the polystyrene are relieved before they can cause cracks.

55. Antibiotic Aureomycin

SEVERAL diseases not controllable by penicillin or streptomycin, now have promise of effective treatment by use of a new antibiotic agent, Aureomycin. First isolated by Dr. B. M. Duggar of the Lederle Laboratories Division of the American Cyanamid Co., 30 Rockefeller Plaza, New York, N. Y., this new antibiotic was the topic of an all day symposium of the New York Academy of Sciences on July 21, 1948. Clinical results so far indicate its use in treating typhus, psittacosis, rickettsialpox, and others.

Aureomycin is so called because of its golden color. It is produced by a newly discovered species of the Actinomycetes and has been called *Streptomyces auerofacians*. Similar to penicillin and streptomycin, the new antibiotic is produced in liquid fermentation tanks, using a nutrient mash. So far, it is being made on an experimental basis on a small scale for use in clinical studies. Aureomycin appears to have greatest possibilities in combating viruses on which streptomycin and penicillin have no effect.

56. Biochemicals

PILOT-PLANT quantities of hemin chloride are now available from the Chemical Research and Development Dept., Armour & Co., Chicago 9, Ill. This material, of animal origin, is an iron-containing compound from bovine blood. It possesses pro-oxidant properties, is relatively insoluble in water and is suggested for use as a colorometric standard in the determination of human hemoglobin. This new biochemical should be of interest to scientists and physicians interested in studying metabolic processes.

57. Catalysts

IMPROVED catalysts for conversion of carbon monoxide to carbon dioxide and hydrogen is now being marketed by Enjay Co., Inc., an affiliate of Esso Standard Oil Co., 15 West 51st St., New York 19, N. Y. Known as Enjay BR-769 conversion catalyst, this material is an addition to the line of catalysts that have been marketed by

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FOR MORE INFORMATION
See Reader Service Coupon on pages 175-176

this company for use in petroleum refining. The new material is an iron-chromium converter catalyst that has a side strength of 50 to 70 lb., and a bulk density ranging from 80 to 100 lb. Normally available in $\frac{3}{8}$-in. pellets, it can be obtained in pellet sizes ranging from $\frac{1}{8}$ in. to $\frac{7}{8}$ in.

58. Copper Welding

DEVELOPED by the Eutectic Welding Alloys Corp., 40 Worth St., New York 13, N. Y. is a torch-welding rod used for welding copper. Known as Eutecrod 1805 FC it is a thin-flowing, low-melting, brazing alloy with high tensile strength and a Brinell hardness of 160-180. It is available in various sizes, flux coated and bare. Designed particularly for chemical process equipment, plating and fittings, copper tanks and tubing, copper valves and other similar equipment. It is used with a torch adjusted for an oxidizing flame, atomic hydrogen or twin-carbon arc where no oxyacetylene equipment is available.

59. Automobile Polish

TWO NEW polishes for use with automobile rubbing and polishing machines are now being marketed by E. I. du Pont de Nemours & Co., Wilmington, Del. They are VZ-1196 Duco Machine Polishing Compound No. 14 and VZ-1202 Liquid Machine Polish. Both are designed for use by professional automobile refinishers. The No. 14 compound cuts faster, is less greasy and is easier to clean up than previous products of a similar nature. The Liquid Machine Polish was developed to supply a polish for use with standard polishing discs or lambs wool bonnets.

60. Leather-Stretching Formula

A SPECIAL shoe and leather stretching formula is being manufactured by the Security Manufacturing Co., 14 West 27th St., New York. While increasing softness and pliability and replacing the natural leather oils, it is said to retain the stretch. Called Extenzit, it will be marketed in quart and gallon cans. It will stretch shoes,

Robins Hydrex Screen quickly removes fibrous impurities

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That was the problem faced by the United South Africa Company, Guttenberg, New Jersey. Every quarter-hour, palm oil clarifiers had to be shut down for cleaning. Production came to a standstill dozens of times a day. Costs soared.

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2. **Save solids from liquids.**
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old and new, from ½ to 2 sizes larger in length and width. Soaking and tempering time is cut about 75 percent by a solution of ½ to 1 glassful of Extenzit to 1½ gal. of water'. It is also used for softening dried up light leathers.

61. Hydrocarbon Solvents

In the Gulf Coast area, Esso Standard Oil Co., 15 West 51st St., New York, is manufacturing three commercially pure hydrocarbon solvents. Known as Esso Hexane, Esso Heptane and Esso Octane, they are available for bulk shipment; they are brought to the East Coast by tankers.

These close-cut hydrocarbons should prove useful in the manufacture of protective coatings, rubber and vegetable oil extractions. Greater control in coating formulations, uniform evaporation rate from start to finish, improvement in odor, freedom from residual odor, less solvent retention by most resins and greater flexibility for blending should be made possible by these hydrocarbons.

62. Wire Rope Protection

Deterioration of wire ropes and cables caused by weathering and corrosion can be minimized by the use of a new compound manufactured by the L. Sonneborn Sons, Inc., 88 Lexington Ave., New York 16, N. Y. Consisting of a blend of high melting petroleum lubricants, anti-corrosion agents, and finely dispersed pigments of high tinctorial strength, the new compound is claimed to possess good durability, high elasticity, and positive adhesion. It is designed to withstand fairly high temperatures and will not deteriorate on exposure to salt water sprays, corrosive fumes or vapors. At the same time, internal movement in the rope or cable will not displace the compounds.

Having the brand name of LSS Wire Rope Compound, this material is said to be easy to apply and will dry tack–free in 24 hr. The coated wire can be rolled on a reel without danger of the compound rubbing off. In addition to preventing rust and acting as a lubricant, this compound can be supplied in any color desired, making it possible to give a distinctive identifying color to the rope.

63. Bronze Electrode

Immediate availability of the new silicon bronze electrode has been announced by the Air Reduction Sales Co., 60 East 42nd St., New York 17,

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Announcing the "DAHL-SEAL"

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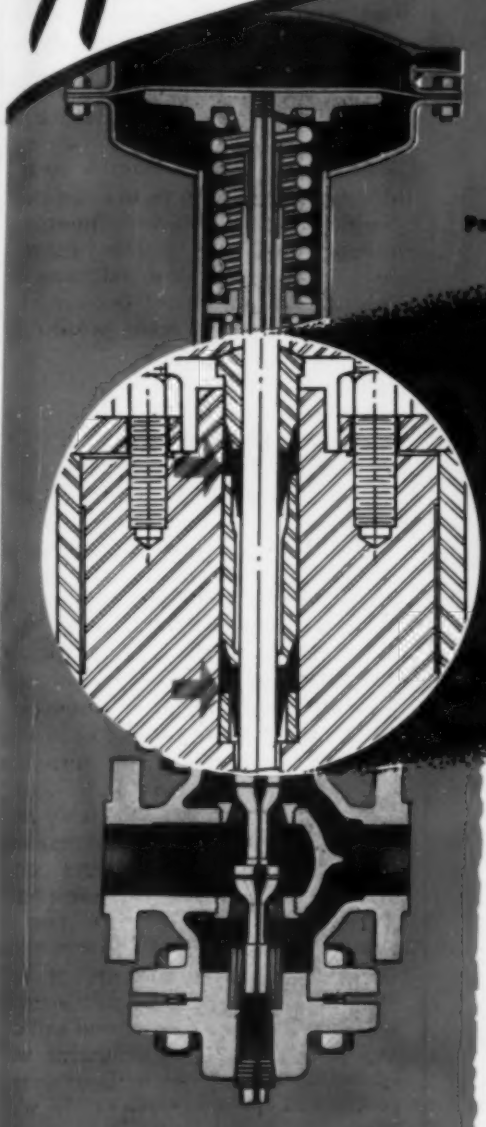

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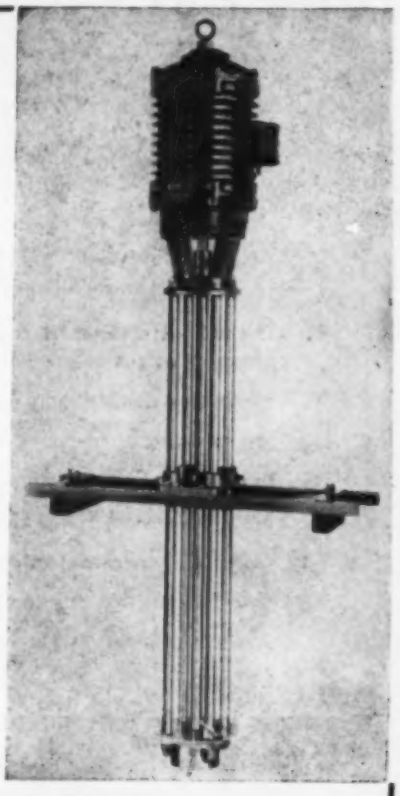

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N. Y. This new electrode was developed for use in the welding of silicon bronze base metal, copper, and for joining galvanized iron and silicon bronze to steel. It is suggested for use in the manufacture of chemical and food processing equipment, and is available in various convenient diameters and lengths.

64. Chlorobenzotrifluoride

NOW MANUFACTURED in pilot plant quantities, *m*-chlorobenzotrifluoride is available from the Hooker Electrochemical Co., Niagara Falls, N. Y. This compound also known as *m*-chlorotrifluoromethylbenzene is another member of a series of benzotrifluoride derivatives previously announced. Similar to products of this series, it is suggested for use in the preparation of dyestuff intermediates and other fluorine containing organic chemicals.

This compound is a clear color, colorless aromatic liquid and is characterized by the trifluoromethyl radical which is generally stable to heat, light and chemical reaction. It has a distillation range of 134.8 to 138.6 deg. C., a freezing point of —56 deg. C., and a specific gravity of 1.446 at 15.5 deg. C.

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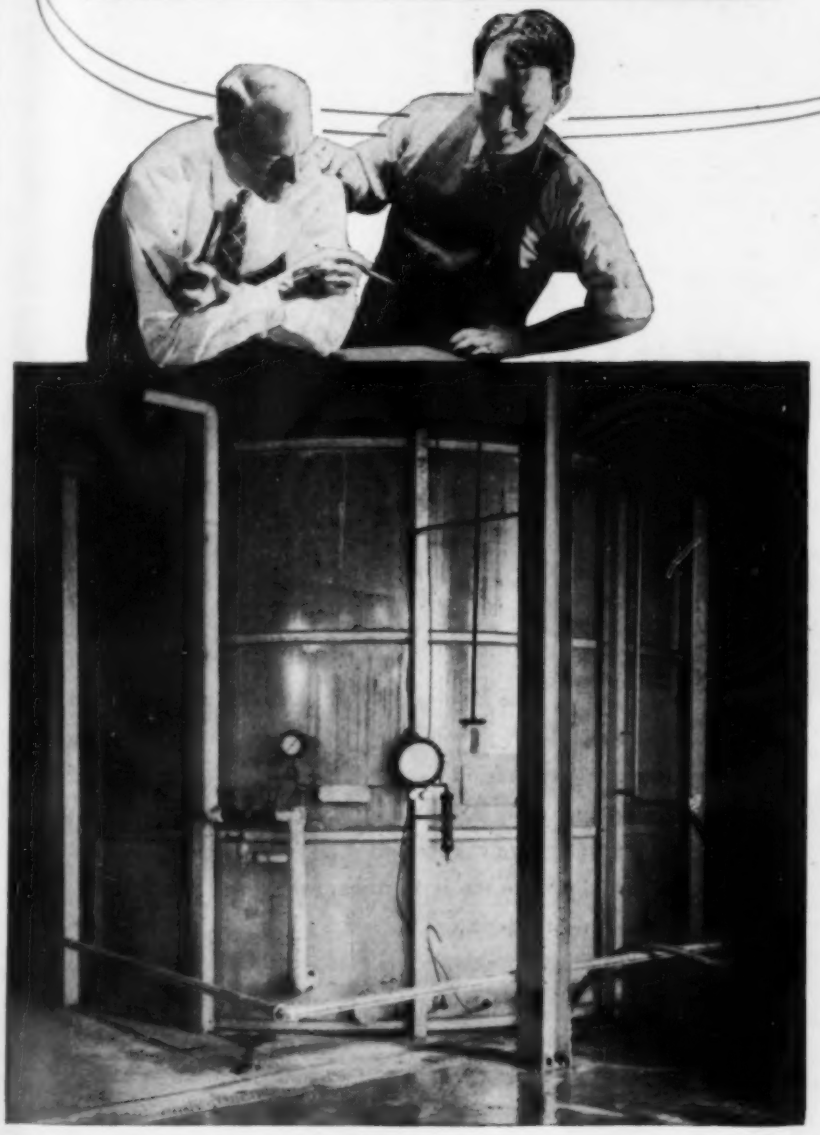
- *must maintain strength at extremes of temperature and pressure*
- *must safeguard product purity*

build it with U·S·S Stainless Steel



Stainless Steel is used in this tank which stores the highly acid urea used in the manufacture of plastics. Unaffected by these acids, it stores the acid safely.

● Users and builders of chemical processing equipment will find in U·S·S Stainless Steel the answer to many of their toughest problems. And for these reasons: (1) No other commercial metal can equal Stainless Steel for its high resistance to so many types of corrosives; (2) Stainless Steel is unsurpassed for retaining strength at high or low temperatures; and (3) Stainless Steel is available in such a wide range of analyses and in so many different forms that it will meet almost any service condition or fabricating requirement.

It is well to remember, too, that recent advances in the technology of industrial chemicals, synthetic rubber, plastics, dyes, soaps, high octane gasoline, pharmaceuticals, paper and textiles have been paralleled by equally important developments in the field of Stainless Steel. The versatility of this superior corrosion-resisting and heat-resisting steel group has been constantly extended so that it is safe to say: the more severe the service, the greater the need for Stainless Steel.

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Our engineers are specialists in their use and will gladly give you the benefit of their many years' experience to insure you optimum benefits at minimum cost. They have behind them the research and laboratory facilities of the world's largest producer of fine steels. For their assistance, simply outline your problem and write to United States Steel Subsidiaries, Room 2044 Carnegie Building, Pittsburgh 30, Pa.

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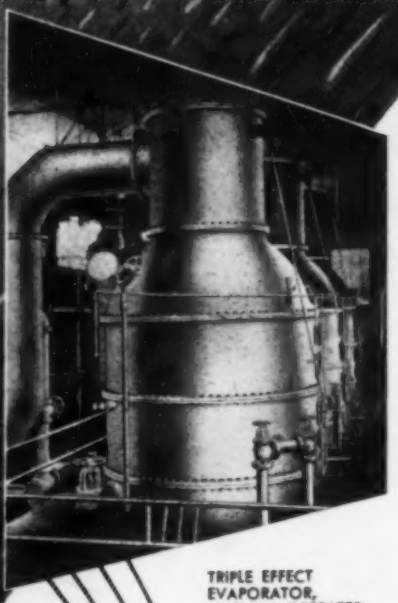

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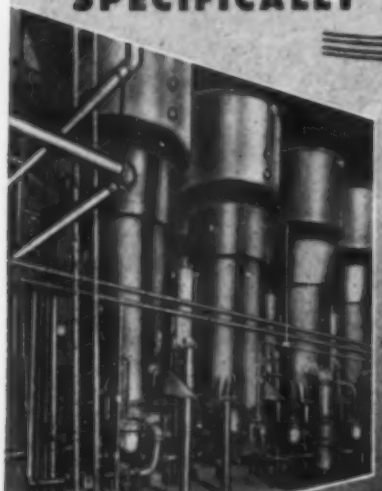

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MEN, MACHINES AND METHODS

Roger Williams, Jr., ASSISTANT EDITOR

Chemical Safety

This month's National Industrial Safety Conference and the 36th National Safety Congress make a look at the chemical industry's record worthwhile; the record is not too good.

THE occasion of the President's National Industrial Safety Conference, to be held in Washington September 21-23, and the 36th National Safety Congress, in Chicago October 18-22, is a good time to take a sobersides look at safety. We will agree with the president when he calls the 1947 record of 2,000,000 injured, 17,000 killed, and 91,000 disabled "sad."

In the past few years many an executive has come to the conclusion that safety pays. And it has not been because of any altruistic motive, although executives deplore as well as anyone else the sad disruption that accidents can cause in human affairs.

Just why does safety pay? Safety pays a company because in the last analysis it means more production and more profits. When an accident occurs it usually means that a piece of equipment is out of production, at least for a time. It may mean that a piece of productive machinery is completely ruined and must be replaced. An employee in a safety-conscious plant has higher morale, and that usually means more production. Those are indirect effects, but there are direct ways that safety pays. Many a safety program has paid for itself merely by the reduction it has brought in insurance premiums. Disability payments go down along with the number of injuries.

Perhaps John S. Shaw of Hercules has summed it up when he said "I think we have long since passed the point where we have to be convinced that safety pays. It is an important part of industrial operations."

If safety pays, then the next step is to examine the record of the chemical industry, to determine how well it has been doing in safety. By its very nature the chemical industry is hazardous, and that must be borne in mind when considering the industry's record. Dealing with explosives, acids, flammable solvents and other hazardous materials, the chemical companies must constantly be on guard. Of course, when considering such a thing as safety, there is no situation which cannot be improved. There is no accident rate too low. But the chemical industry can compare its records with those of other industries, knowing full well that it is basically more hazardous than some of them. Here is what the statistics of the National Safety Council show for 1947:

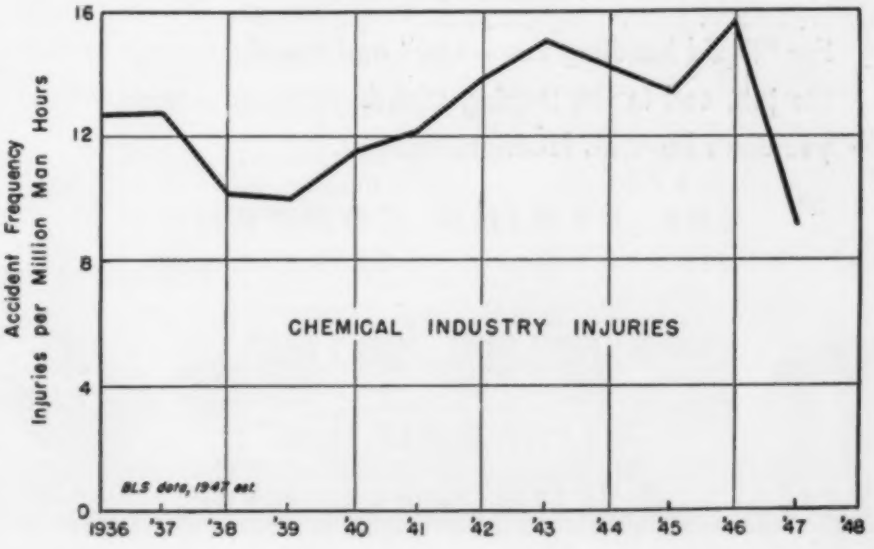
(1) In frequency of injuries, the chemical industry stood 9th out of the 40 industries reported. The following had better records: communications, electrical equipment, steel, tobacco, aircraft manufacturing, cement, railroad equipment, and textiles. Per man-hour worked, the communications industry had only one-third as many injuries as the chemical plants. That means there is real room for improvement.

(2) Considering the severity of the injuries sustained, the chemical companies do not stand up as well. Chemicals stand 17th on the list. Communications again led, and injuries in the communication field were only one-sixth as serious as the average chemical injury. Again there is real room for improvement.

Little Improvement Noted

If the chemical industry does not stand too well today, the next question is to determine whether it is improving or not. A look at the chart gives the answer. These Bureau of Labor Statistics figures certainly do not show any downward trend. Admittedly the estimated results for 1947 are the lowest of any year tabulated, but they still aren't very low, and there is no definite trend apparent. Because of the lack of a trend, it looks like a concerted drive could show real results.

If the chemical industry is not doing too well, what segments of the industry are doing poorly? Whenever safety is considered, there is one factor that is of interest. Generally the best safety records are compiled by the two



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extremes—the very large plants and companies on the one hand, and the very small ones on the other. Here is what the Department of Labor says about it:

"In many industries analysis of the accident experience of various plants has shown a direct correlation between the industry-frequency rate and the size of the plant as measured by employment. The most common findings have been that the small plants, in which the owners are in close contact with actual operations, and the large plants, which generally have safety engineers on their payrolls, usually have the lowest average frequency rates. The medium-sized plants, which are too large for intimate supervision by top management, and too small to have regularly-established safety departments, commonly constitute the group which has the highest average frequency rate."

Large Firms More Safe

It is not very hard to substantiate the above for the large companies. In 1947 the chemical industry had almost nine injuries for every million man-hours worked, according to the National Safety Council. But a few of the larger companies report their safety records in their annual reports. Two of them are du Pont with less than one injury per million man-hours, and Monsanto with 3½ injuries per million man-hours (excluding the Texas City casualties). If these figures at all exemplify the type of safety records that the bigger chemical companies are producing, then the place we must look for improvement is to the smaller and medium-sized companies.

If that is the record, it looks like safety efforts should be aimed first at the executives of small and medium-sized chemical plants. It will be the job of all of us who are safety conscious to sell these men the value of safety. Such a selling job should be one of the biggest items on the agenda of the President's National Industrial Safety Conference and the National Safety Congress. A really concerted safety drive by medium-sized chemical companies can result in many worthwhile things. First it can reduce the number of accidents, and by doing so save an untold amount of misery from coming into the homes of its workers. Second it can mean an increased output of chemicals. Third it can mean greater profit. And fourth, but not last, it can result in the best publicity in the world, illustrating once again that chemical executives are in the forefront in employee relations. The cost of such a drive would be small compared to the gain.

COOPER CERTIFIED STAINLESS STEEL VALVES

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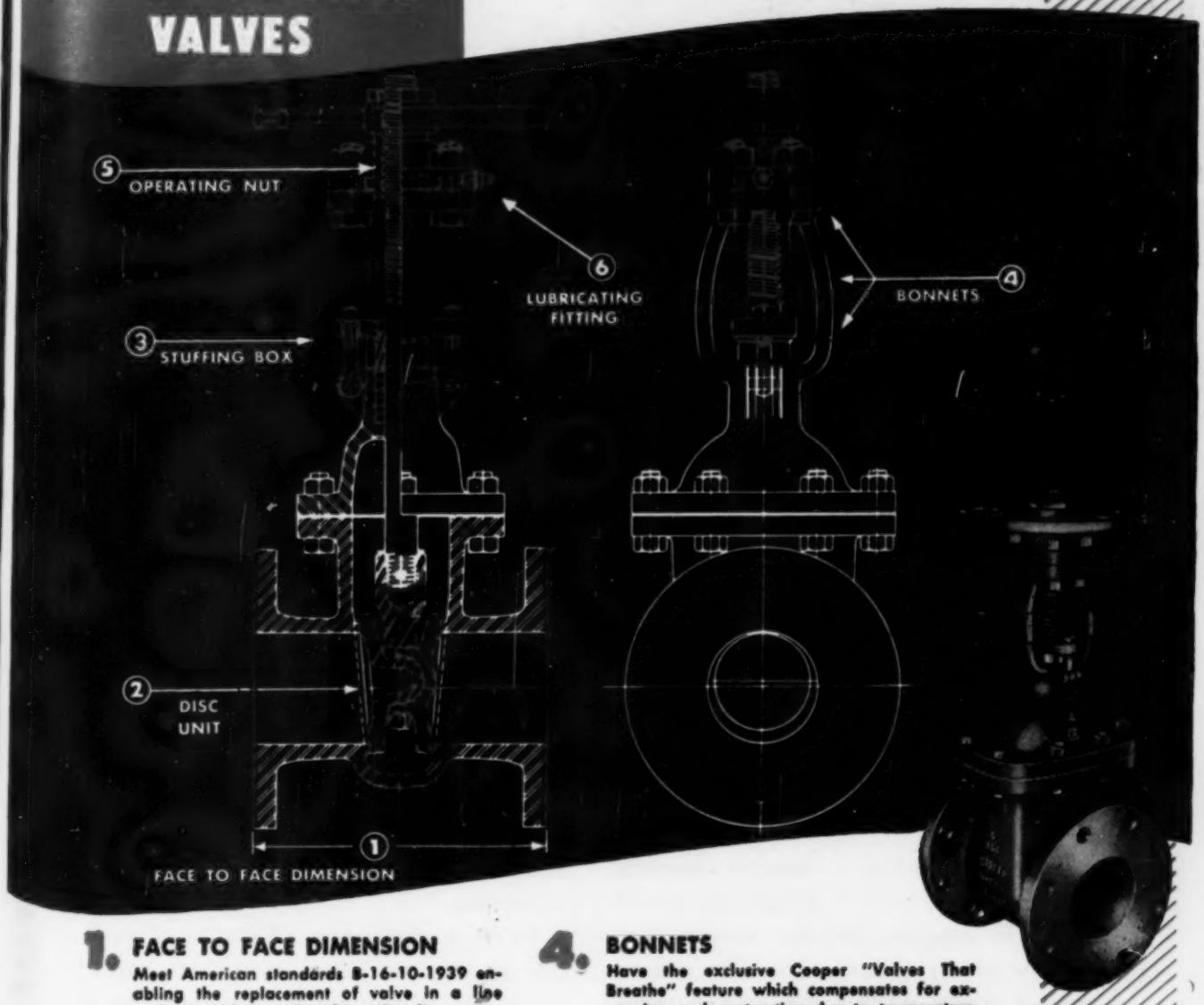

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CHEMICAL ENGINEERING NEWS

Richard F. Warren, ASSISTANT EDITOR

Shell to Get Chemical Achievement Award For Synthetic Glycerine

SHELL DEVELOPMENT CO., the research and development affiliate of Shell Oil Co. and Shell Chemical Corp. is to receive this year's Award for Chemical Engineering Achievement, according to an announcement made by Professor-Emeritus Alfred H. White on behalf of his committee of more than fifty senior educators in the field of chemical engineering. The Award is made in recognition of Shell's successful synthesis of glycerine for the first time on a commercial scale. It also recognizes a long-time program of pioneering in petrochemicals and other outstanding applications of chemical engineering in the petroleum industry.

Chairman White's announcement practically coincides with the formal opening in Houston, Tex., of Shell Chemical Corp.'s new $8 million unit for glycerine production. For more than 12 years this has been a major objective in a comprehensive program of building an entirely new industry based on allyl compounds derived from petroleum hydrocarbons. Already on stream at Houston are other units for allyl chloride, allyl and butyl alcohols, methyl ethyl ketone, propyl and propylene chlorides, acrolein, diallyl ether, epichlorohydrin, glycerol dichlorohydrin and diallyl phthalate. The whole project, involving an investment of upwards of $43 million has been designed by the engineers of Shell Development and installed by Shell Chemical Corp.

"Shell's great postwar program," according to S. D. Kirkpatrick, secretary of the Committee of Award and editor of *Chemical Engineering* which has sponsored this award since 1933, "is based on exactly the sort of coordinated group effort which our award was designed to recognize and encourage in the process industries. It is the result of long-time research, intensive development of pilot-plant processes and product evaluation followed by courageous engineering design and construction. It would not have been possible had it not been for the recognition and generous support accorded Shell's chemical engineers from the inception of the process in the laboratories to its final translation into large-scale commercial production."

Presentation of the Award will be made at a dinner in the Waldorf-Astoria Hotel in New York on Wednesday, November 10—directly following the Annual Meeting of the American Institute of Chemical Engineers. As in the past, interested members and friends of the chemical engineering profession will be invited to share with the Committee in according this recognition for outstanding achievement. Details of the program and other arrangements will be announced in these pages next month.

Reserve Specialists Will Include Chemical Engineers

U. S. AIR FORCE is taking the initiative in establishing a corps of reserve officer specialists in grades from second lieutenant to colonel. This action is "designed to create a source of personnel proficient in civilian specialties immediately adaptable to use . . . in the event of mobilization." Applicants are sought who by education and experience are qualified to serve, among other duties, as production inspectors, equipment maintenance officers, and specialists engaged in design and development of equipment and materials. The jobs to be filled include some commonly handled by chemical engineers.

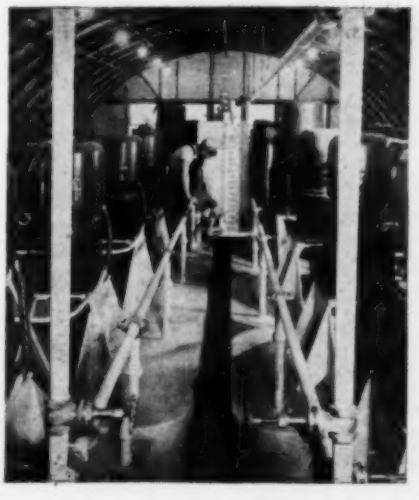
Interim Freight Rate Rise Now Permanent

FORMAL approval by Interstate Commerce Commission has made permanent the freight rate increases granted in an interim order of May. Practically all products of chemical industry must stand new schedules ranging from 20 to 30 percent above those of 1947. A large part of raw material supply also will now travel at these higher freight rates. Chemical managements thus have the problem of new "high cost of freighting" in business to parallel the housewife's worries about "high cost of living" at home.

National Chemical Exposition Coming to Chicago

PLANS for the fifth National Chemical Exposition to be held October 12 through 16 at the Coliseum in Chicago include the revival of the National Industrial Chemical Conference. The conference will feature noted speakers who will present papers on chemical markets, chemistry in general industry, chemical hazards, management of research, and frontiers of chemistry. Sessions of the conference will be held in the Coliseum Annex starting on Tuesday evening, October 12.

Another feature of the exposition will be the installation of the Technical Bureau manned by Dr. W. B. Evans, retired chairman, Chemistry Dept., Northwestern University, and



These explosion-proof tanks are part of Arco's new Cleveland lacquer unit.

now professor of chemistry at Loyola University. Another feature, Chemical Trail Blazers, will be repeated this year on a larger scale. A special committee is searching for new developments and discoveries to add to the educational value of this instructive display. Sketches, panels and specimens will be presented.

In summarizing the importance of the exposition, the committee stated that even research chemists will find among the exhibits applications and treatments not too familiar to them. They will go beyond the practical developments displayed in the regular commercial booth.

The show will be open from noon to 10 p.m. daily except on a closing day when it will run from 10 A.M. to 6 P.M.

Torrance Is Site of New Ethylene Dibromide Unit

To MAINTAIN production during peak soil fumigation months, Eston Chemicals, Inc., wanted a plant that would run at maximum capacity for long periods. There were other problems too. Design would have to take into account the large amount of heat from the reaction and the corrosive nature of the bromine and HBr.

The manner in which the ethylene dibromide plant was constructed—and the problems solved—may be seen at Torrance, Calif. The unit is on RFC-leased land next to the styrene plant of the synthetic rubber project. Ethylene and cooling water come from the styrene plant, bromine from American Potash & Chemical Corp. Reactor design shows an intricate lead-lined column with cooling coils. (Lead was the only corrosion-resistant material available at the time.) The column is packed with small glass raschig rings.

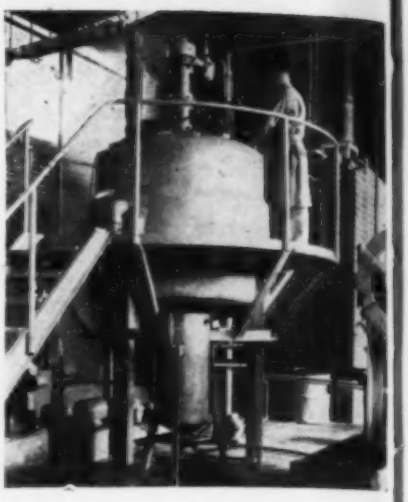
Ethylene is introduced into the bottom of the column through a reducing valve on the line supplying the styrene plant. Bromine is fed directly from 200-lb. drums. Gases emitted from the tower's top are passed through a water-cooled glass condenser. Non-condensable gases are scrubbed with caustic and released into the air.

Finished ethylene dibromide is drawn off from the column base and put through a caustic wash which removes any HBr and Br_2. After being further washed with water, it is transferred to a large tank, then decanted into drums. Final mixing into a marketable product is done at Eston's main plant at Vernon, Calif. The Torrance unit was constructed and placed in operation under the direction of Eston's plant manager Russel Sunderlin. Production is under the direct supervision of William Weber.

American Smelting Building Sulphuric Unit at Tacoma

CONSTRUCTION work is under way on a contact plant at the Tacoma smelter of American Smelting & Refining Co. Cost is placed at $1,000,000; rated capacity at 100 tons daily; completion date within 18 months. Another unit of equal capacity may be built later if the market warrants, states Smelter Manager Earl R. Marble. Plans for the operation are being prepared under the direction of C. C. Burt, chief engineer of AS&R at Salt Lake City.

A 500x125 ft. area is now being cleared at Tacoma on which the cleaning unit (with Cottrell precipitators, scrubbers and mist precipitator) and the acid plant will be built. Waste SO_2 gases from the AS&R smelter will be used, thus alleviating the fume situation. Previous plans of the firm to install a liquid SO_2 plant at Tacoma have probably been shelved for the present. With the exception of a 35-ton unit operated at the Du Pont powder works near Tacoma, the new plant will be the only H_2SO_4 producer north of Selby, Calif., and west of Anaconda, Mont. The product will be used by food processors, paper mills, fertilizer plants and other processing industries.

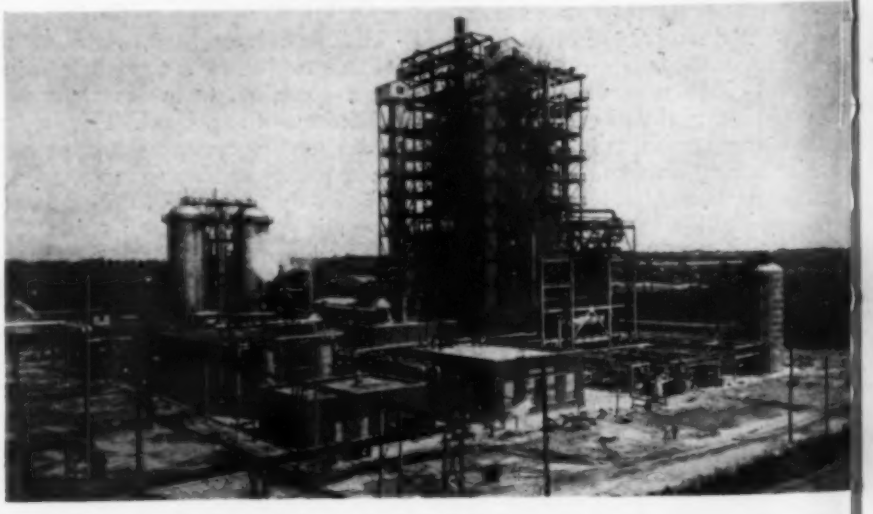


New esterification kettle means . . .

More Fatty Acid Esters as Griffin Chemical Expands

FATTY acid esterification has become the forte of Griffin Chemical Co. since the end of the war, and the firm's Richmond, Calif., plant is the only West Coast producer of emulsifiers based on polyhydric alcohol esters. From 1940 until the war's end, Griffin was the Coast's principal refiner of petroleum sulphonates. Then came the move into the esterification field, an expansion that still continues in the direction of specialized wetting agents.

Raw materials include glycerine and other polyhydric alcohols, vegetable and animal fatty acids. These are re-



New cat cracker . . .

. . . at Sugar Creek, Mo., refinery of Standard Oil Co. of Indiana was inspected on August 12 by A. W. Peake, president of the company, directors from the general office in Chicago, civic leaders and representatives of the press and radio from the Sugar Creek and Kansas City area. Construction work on the fluid catalytic cracking unit was started in January 1946 and the unit was completed early last July and has been in operation since then.

To give you an accurate laboratory prediction of performance on your job, READCO will conduct tests with the material you want mixed—before quoting.

Experienced engineers design your READCO Mixers to suit your individual needs, incorporating the features that will assure maximum mixing efficiency for your particular product.

No guesswork!

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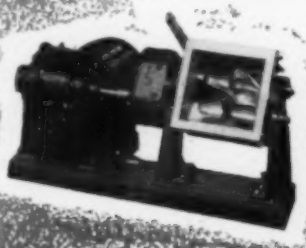
Whatever mixing problems you have, READCO Mixers can solve them . . . because they are "individually tailored" to fit your particular operation. In addition, "plus features" help you reduce overhead and boost profits by increasing your production and improving quality. These READCO models are typical:



DOUBLE ARM VACUUM MIXERS have single packing gland construction which eliminates the possibility of contamination or oxidation. Heavy duty construction of common metal or any commercial alloy. With or without jackets. Non-vacuum mixers also available.

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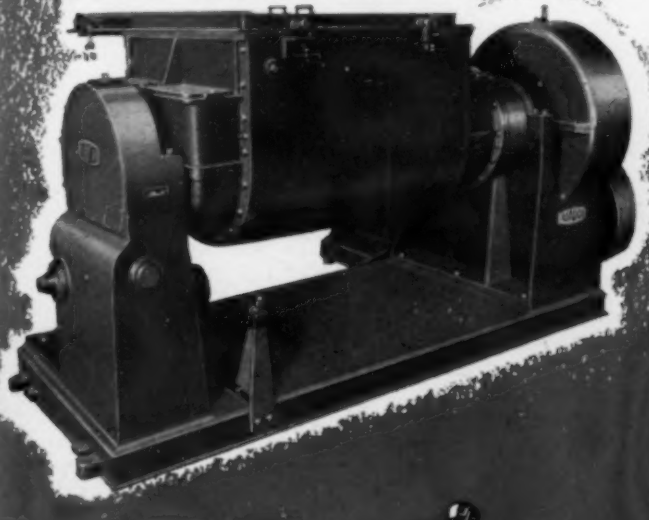

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MACHINERY DIVISION

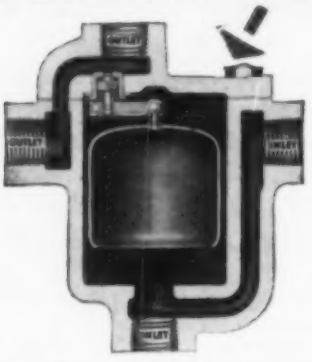
of THE STANDARD STOKER COMPANY, INC. YORK, PA.

CHOOSE CLARK
All down the line

A NEW TRAP
JOINS A
FAMOUS LINE

Clark Traps

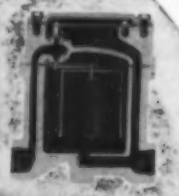
INTRODUCING THE NEW CLARK "60"



Series "80"
Inverted Bucket
Steam Trap

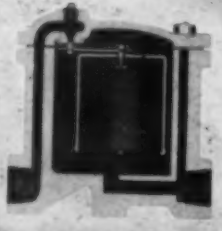
"CRV"
Pressure
Regulator

A small trap with big trap features. Positive seating with guided disc. Equipped with *two inlets* and *two outlets* for easy installation for horizontal, vertical or angle connections.



Let Clark's 40 years of experience be your guide in selecting the proper trap or valve for your drainage needs.

Series "70-T"
Inverted Bucket and
Blast Steam Trap



Write today for complete story on Clark Traps and Valves.

THE CLARK MANUFACTURING CO.
1833 EAST 38th STREET • CLEVELAND 14, OHIO

Series "70"
Inverted Bucket
Steam Trap

Clark

TRAPS — FLOAT, INVERTED BUCKET, OPEN BUCKET AND VACUUM • REDUCING VALVES • STRAINERS

acted to form a series of polyhydric alcohol esters. Keynote of the esterification unit is flexibility in layout and equipment. This plant has four stainless steel kettles of 500 to 1,000 gal. capacity. Each is steam jacketed, provided with vacuum and can be blanketed with inert gases, either CO_2 or N_2. Turbine-type impellers give variable agitation. Each kettle is provided with controls so temperatures can be held within 1 deg. F.

Two rectifying columns recover and purify solvents for re-use. A number of blending tanks, filter presses and other equipment are tied in with the esterification apparatus. The two oleic acid storages are lined with stainless steel and have steam coils on their outside bottoms.

Other equipment includes facilities for producing and refining three types of petroleum sulphonates, preparation of DDT solutions and other products. The plant has facilities for designing,

CONVENTION CALENDAR

National Plastics Exposition, Grand Central Palace, New York, September 27, October 1.

American Gas Association, Atlantic City, N. J., October 4-8.

Fifth National Chemical Exposition, Coliseum, Chicago, Ill., October 12-16.

Electrochemical Society, 94th general meeting, Pennsylvania Hotel, New York, October 13-16.

Technical Association of the Pulp and Paper Industry, third engineering conference, Statler Hotel, Buffalo, N. Y., October 25-28.

Association of Consulting Chemists and Chemical Engineers, annual meeting, Hotel Sheraton, New York, October 26.

American Institute of Chemical Engineers, annual meeting, Pennsylvania Hotel, New York, November 7-10.

National Paint, Varnish, and Lacquer Association, Congress Hotel, Chicago, Ill., November 8-10.

American Petroleum Institute, annual meeting, Stevens Hotel, Chicago, Ill., November 8-11.

American Oil Chemists Society, fall meeting, Pennsylvania Hotel, New York, November 15-18.

18th National Exposition of Power and Mechanical Engineering, Grand Central Palace, New York, November 29-December 4.

Synthetic Organic Chemical Manufacturers Association, annual meeting, Commodore Hotel, New York, December 8.

IF *your products have a reputation for:*

DEPENDABILITY...
UNIFORMITY...
HIGH QUALITY

...guard that reputation well with **PENN-DRAKE White Oils and Petrolatums**

The base you use does not in itself guarantee the purity of your product, but it is certain you cannot have a high quality drug or cosmetic product without a high quality base. Penn-Drake White Oils and Petrolatums are free from odor and all impurities, including acids and alkalies. A complete line of standard products is offered. In addition, Penn-Drake has a Specialized Service which will give you items which are "slightly different." So, whatever your base problem may be, Penn-Drake can give you a pure product to solve it.

PENNSYLVANIA REFINING COMPANY

BUTLER, PENNA.

REFINERIES: KARNS CITY AND TITUSVILLE, PENNA.
BRANCHES: CLEVELAND, OHIO, AND EDGEWATER, N. J.
Representatives in all Principal Cities

penn drake
petroleum products

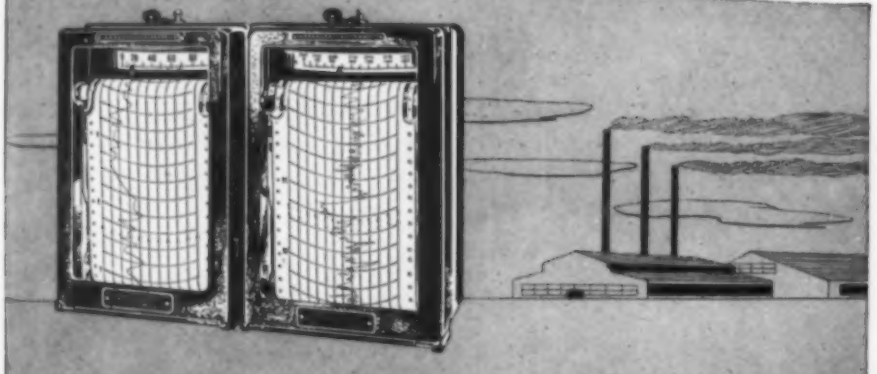
9 out of 10 industries Need Bendix-Friez Wind Recorders for Smoke Abatement Installations

Equipment for smoke and fume control is not complete without permanent records of wind-speed and direction. Write us about Aerovane.*

*TRADE MARK

Aerodynamic transmitter is easy to install and modern in design.

Wind speed, wind direction permanently recorded indoors.



FRIEZ INSTRUMENT DIVISION
OF BENDIX AVIATION CORPORATION
Baltimore 4, Maryland

Bendix
AVIATION CORPORATION

fabricating and installing most of its equipment needs. It also has pilot plant and development facilities. Walter P. Ruedrich is plant manager at Richmond; Paul Ruedrich is in charge of the research laboratory located in San Francisco.

Principal Griffin products: polyethylene glycol oleates, stearates and laurates (mono- and di-); glyceryl monostearate; petroleum sulphonates; ethylene and propylene glycol oleates and stearates; 25 percent solutions of DDT, both straight and emulsifiable; specialty and custom manufactured emulsifiers and solubilizers.

Socony-Vacuum Doubles Fellowship Program

SOCONY-VACUUM OIL CO. has appropriated $50,000 to double its program of fellowships in chemistry and physics at a number of schools. In addition to the ten fellowships set up last year and which are being continued, at least ten more will be established for the 1949-1950 school year. The original fellowships, each for $2,000, are being continued at California Institute of Technology, Harvard, Massachusetts Institute of Technology, Notre Dame, Ohio State University, Princeton, Rice Institute, Yale and Universities of Wisconsin and Illinois. Names of the institutions selected for the new fellowships had not been announced up to a few weeks ago.

Under their arrangements with the company the schools select the recipients from among students with at least one year of graduate work. Socony places no conditions upon the winners as to their future place of employment and as to publishing results of their investigations, nor does the company stipulate that the recipients study subjects related to petroleum.

Social Security Statistics Aid in Market Research

INDUSTRY has a selfish reason for insuring that quarterly social security returns are completely reliable. The old-age and survivors insurance figures as reported by industry are used for compiling statistics valuable in market research and other business planning. Such data for the first quarter of 1946 were published recently by the Department of Commerce.

In filling in the returns, manufacturers are urged to give particular attention to the item which asks for the number of persons employed during the pay period which ended nearest to the 15th of the third month of the

YALE

now offers a CARTRIDGE HEATER* that, first of all, lasts longer

In the new YALE Cartridge Heater the resistance element is embedded directly into refractory cement, which is then fused. A direct path of heat conductivity is thus provided, from resistor to sheath. This means lower resistor operating temperature, and consequently longer heater life.

But that's not all. When it's YALE heat, it's *uniform* heat. With a YALE made unit there is always

1. Uniform distribution of the refractory within the sheath for *uniform insulation.*
2. Accurately centralized location of the resistor—equidistant from the sheath throughout its length—for *uniform heat transfer.*

Prompt shipment on Cartridge Type Heating Units—one of a *complete* YALE line of electric heaters.

Please use coupon below to receive full information on this and other types of YALE *Electric* Heating Units.

*Screw plug type for liquid immersion. Plain cartridge type for general uses.

YALE *Electric* UNIFORM HEAT
THE BRIGHT SPOT IN ELECTRIC HEATING

TRADE **YALE** MARK

Makers of the famous YALE lines of Locks, Door Closers, Pumps, Hoists, Industrial Trucks and Scales.

THE YALE & TOWNE MANUFACTURING COMPANY
YALE *Electric* HEATING UNIT SALES
Room 1037, Chrysler Bldg., New York 17, N. Y. • Murray Hill 9-6700

Please send catalog with full information on YALE Cartridge Type Heating Units. Our proposed application is described below.

.....

.....

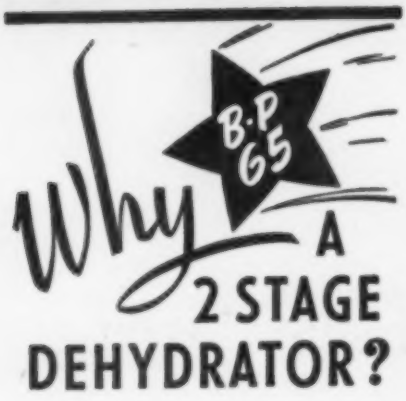
NAME.....

TITLE.....

COMPANY.....

ADDRESS.....

CITY.....ZONE.....STATE.....



A conventional Dessicant dehydrator for small capacity service is often too expensive to operate because at times the moisture present is approximately:

90% Free water
10% Dissolved water

When a dessicant dehydrator "ONLY" is used the entire load of *free* and *dissolved* water must be handled in one stage, causing frequent and expensive re-activation operations.

By using the widely accepted Excel-So Separator *ahead* of the dessicant chamber, all but the smallest trace of free water is removed at NO operating expense, except for an infrequent replacement of the coalescing pack at negligible cost.

With as much as 99.9% of the free water already removed, it is possible to use a comparatively small dessicant chamber that will not require re-activation. The dessicant can be thrown away much cheaper than the expense of re-activation drying equipment . . . even for years of operation.

USE THIS COUPON

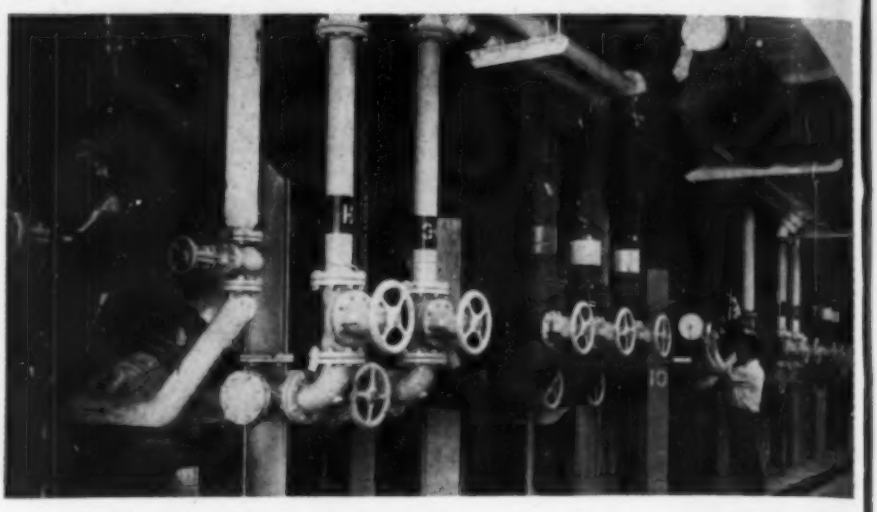
WARNER LEWIS
COMPANY
BOX 3096C TULSA, OKLAHOMA

Name _____

Street _____

City _____

quarter. The figure should include all employees on the payroll during that period whose services are covered by the Social Security Act. It should exclude persons who received no compensation during that period.



These gigantic mixing vats mean more latex for Goodyear's new special products plant in Akron. The latex will be used for foam-rubber mattresses and upholstering.

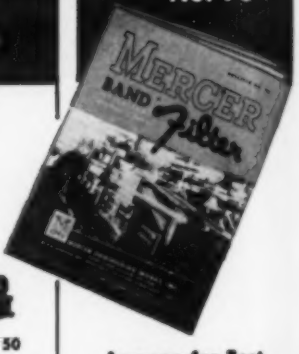
Monsanto Reveals New Process For SO_2 Recovery

A FLEXIBLE, low-temperature process for sludge acid recovery which produces a gas higher in SO_2 content than that of burning pure sulphur was announced last month by Monsanto Chemical Co.

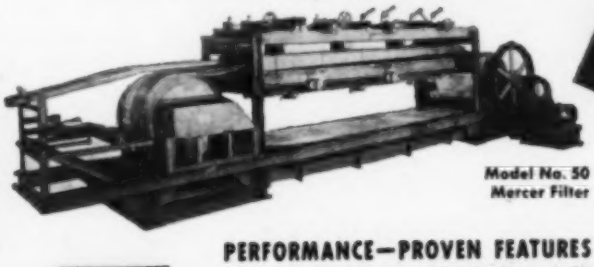
The new continuous process, known as the Monsanto-Ross-Wilde process, was developed during the war and

MERCER
BAND Filters
FILTRATION
WASHING · DRYING

WRITE FOR MERCER FILTERS BULLETIN No. 70



Low-cost Efficient Continuous Suction Process



Model No. 50
Mercer Filter

PERFORMANCE—PROVEN FEATURES

Multiple washing zones. Evenly formed filtered cake. Varied thicknesses. Automatic cake discharge. Continuous filter medium cleansing. Low power consumption.

Arrange for Test

Mercer plant is equipped to conduct and report upon experimental tests made with samples of your materials. Inquire about this service.

"The Name that Carries Weight"

MERCER ENGINEERING WORKS, INC.
REPRESENTED BY MERCER-ROBINSON COMPANY, INC.
30 CHURCH STREET, NEW YORK 7, N. Y.

Sales Offices in Principal Cities

Here Is Why You Can
REDUCE PROCESS DOWN-TIME

When You Use *Carpenter* STAINLESS TUBING . . .

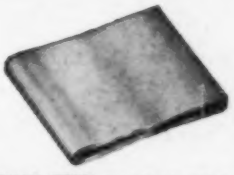
Longer equipment life with less time spent for tube replacement is one result you get by using Carpenter Stainless Tubing. For full corrosion resistance, plus the long service life that consistently uniform tube walls give you, specify Carpenter Stainless Tubing on every order.

And you save money in fabrication, too. Bending, expanding, joining, welding, etc., can be done rapidly to make trouble-free installations.

To prove that your process down-time can be reduced, drop us a line. We will be glad to work with your engineers.

Acid heater with removable bundle of 128 Carpenter Stainless Tubes, 1½" O.D., Type 316. Easy fabrication combined with long service life on process lines is the reason why the manufacturer always specifies Carpenter Stainless Tubing.

YOU GET LONGER EQUIPMENT LIFE with the Stainless Tubing That Passes These Tests—



FLATTENING TEST protects you against the possibility of O.D. defects. Specimen is flattened between parallel plates until distance between plates is 3 times the tube's wall thickness. Any sign of cracking or flaws is cause for rejection.

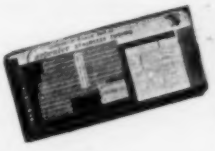
TRANSVERSE BEND is used to double-check the I.D. structure of Carpenter Stainless Tubing. Sample is slit longitudinally and then bent as in the flattening test, but in the opposite direction.

These tests, made at several stages of manufacture, prove quality of the entire tube section and are made on every lot of full finished Carpenter Stainless Tubing before it is released for shipment.

Carpenter

STAINLESS TUBING

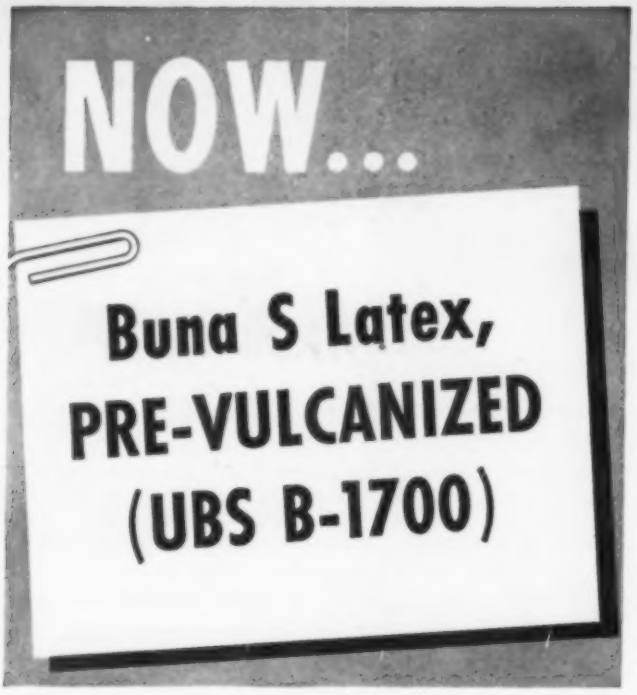
"MORE THAN CORROSION RESISTANCE"



STAINLESS TUBING DATA to help you improve your product's performance is a part of Carpenter service. A note on your company letterhead will bring you a copy of the Carpenter Stainless Tubing Slide Chart containing data on physical properties, sizes available, etc.

THE CARPENTER STEEL COMPANY

Alloy Tube Division • 105 Springfield Road, Union, N. J.



. . . 2500 lbs. tensile strength minimum
. . . dry, non-tacky film
. . . no adding of vulcanizing agents . . . no heat treatment necessary other than drying

PROPERTIES

1. Dried film tensile strength.....2500 lbs. per sq. in. minimum
2. Dried film ultimate elongation....700% to 800%
3. Viscosity.....Thin
4. Specific gravity.....1.012
5. pH Value.....9.3 to 9.8
6. Solids content.....33%

APPLICATION

1. Back coating of rugs and fabrics to impart non-slip and fibre binding characteristics.
2. Coating and impregnating of fabric, paper and wadding for strength, water resistance, and base for further coating.
3. Preparation of molds utilizing properties of flexibility and freedom from further heat treatments.
4. Dipped goods where deposition of film is complete on drying.
5. Adhesive for paper, fabric and leather where bond is improved by film deposit of cured Buna S.
6. As an additive to natural latex, as well as to buna and neoprene, for extension and modification.

P.S.
It is proposed to supply pre-vulcanized Buna S Latex in a more concentrated form if the demand is great enough to warrant it.

Write for detailed data sheet.

UBS
UNION BAY STATE
Chemical Company Inc.
50 HARVARD STREET, CAMBRIDGE 42, MASS.

has since been perfected. It is flexible enough to operate efficiently on any strength refinery acid waste sufficiently fluid to be pumped, according to T. R. Harney, manager of the company's engineering sales department.

Recorded over long periods of operation, the process yields over 98 percent of the recoverable sulphuric acid of the sludge feed. Gas leaving the decomposer unit shows a strength of 70-90 percent sulphur dioxide. After combustibles have been removed, this gas strength is actually higher in SO_2 content than that of gas obtained by burning pure sulphur. It is particularly suited for production by the contact process, and for the production of liquid SO_2.

"The process will accommodate any type of sulphuric acid-hydrocarbon sludge," Harney said. "The only requisite is that physically the final feed sludge be a pumpable liquid. Chemically, it should contain a minimum of 0.08 lb. of hydrocarbons per pound of titratable H_2SO_4."

West Coast Gets Another New Paint Plant

In California, National Lead Co. already had paint factories in San Francisco and the Melrose district of Oakland. To supplement output for the state's fast growing needs, it wanted another. From plans to performance took over a year—official opening of a $1,000,000-plus unit in Los Angeles was observed in July. A full line of Dutch Boy paints will be produced.

Plant layout—modern in every detail—provides simplest routing of materials from railway siding to end of the production line. Dry pigments are stored on the third floor where the nine mixers are installed, each with a dust collector attachment. Hoppers for the pebble and ball mills on the floor below are at floor level. Liquids are pumped from 26 outside tanks having a total capacity of 170,000 gal. These tanks, adjacent to the factory, are in concrete-walled pits capable of holding the entire capacity of each tank, as required by city ordinance. Overhead piping with a 60-ft. clearance allows additional room for construction purposes in the future. Constant pressure is maintained on the lines by individual pumps which switch on automatically when the pressure drops. Liquids are weighed in a scale tank.

Batch masses fall by gravity into hoppers or directly into the mills on the second floor mezzanine. On this floor are two 3-roller mills, a pebble mill, three steel ball mills, a Hy-R-Speed mill and a 5-roller mill. Pastes for thinning and tinting next fall into

PALLET STACKING MOTO-TRUC

PALLET STACKING MOTO-TRUC

Battery Electric Trucks and EXIDE-IRONCLAD® BATTERIES

Speed up materials handling . . . cut costs

Every day, more and more companies are discovering the faster, safer and more economical way to handle materials. They are giving the job of lifting, hauling and stacking to the efficient battery electric truck. Time is being saved . . . more tons moved per man per hour. Handling costs have been cut as much as 50%. And more storage space is being utilized by high tiering.

When electric trucks are powered with dependable Exide-Ironclad Batteries, they keep on the job day after day . . . and all day long.

The unique construction of Exide-Ironclad Batteries results in all four of the vital characteristics of a storage battery: *high power ability, high electrical efficiency, ruggedness* and *long life.*

Speed up your material handling. Cut handling costs. Put Exide-Ironclad Batteries and Battery Electric Trucks to work in your plant.

Write for further particulars and FREE copy of Exide-Ironclad Topics which covers latest developments in material handling and shows actual case histories.

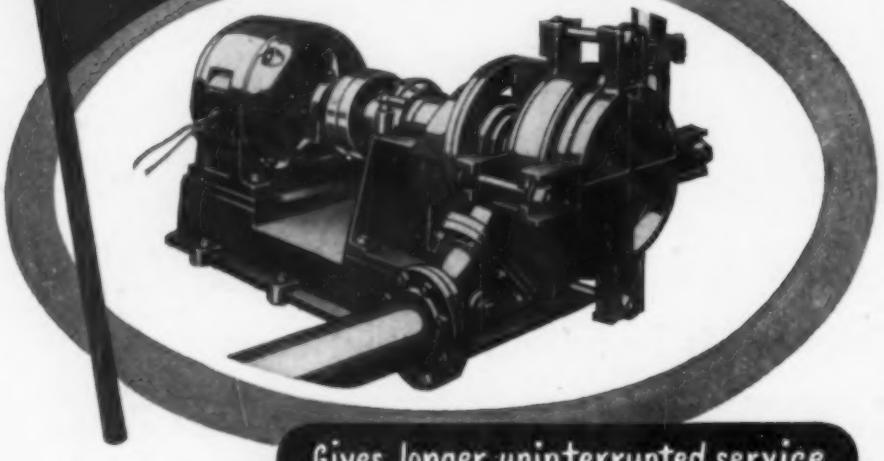
DEPENDABLE POWER

1888 . . . Dependable Batteries for 60 Years . . . 1948

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32 • *Exide Batteries of Canada, Limited, Toronto*

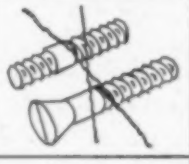
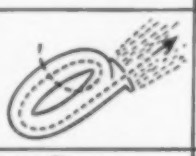
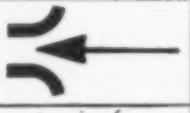
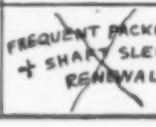
Helps avoid your biggest pump problems

Morris Type "R" Slurry Pump



Gives longer uninterrupted service

Ordinarily harsh abrasives wear out your pump. The corrosive action of acids eats away its utility. Time-consuming maintenance and repairs cut down your production. Now see why the Morris Type "R" helps avoid these problems.

1		**Simple design**—The Morris Type "R" has no internal studs and bolts. Nor does it have troublesome internal joints and fits. The Suction Disc Liner is merely *clamped* into position between disc and shell. *Fewer wearing parts means less maintenance and longer uninterrupted service.*
2		**Easily dismantled**—The impeller and shaft sleeve of the Morris Type "R" Slurry Pump can be renewed *without disturbing* the suction and discharge piping or the bearings. This means considerably less lay-up time.
3		**More abrasive resistant**—With the clamping effect of the bolts on the discs, the shell is not subject to high stress. Consequently, the shell can be made of a large variety of materials, including those of high abrasive resistance. Yet these materials need not necessarily be of high tensile strength.
4		The hydraulic passages of the suction disc are extremely large and velocities are low. As a result, wear is minimized and renewal infrequent.
5		Stuffing box troubles are practically eliminated because the suction gland is under low suction pressure only.

IN CHEMICAL ENGINEERING—Morris Type "R" Slurry Pump handles mixtures containing ore concentrates . . . tailings slag and residue from filters and classifiers . . . all types of caustic or acid mixtures containing abrasives or solids.

MORRIS Type "R" SLURRY PUMP

More easily maintained . . . more easily dismantled . . . more hours of continuous service. Proved by 84 years' Morris experience in pump building.

MORRIS CENTRIFUGAL PUMPS
MORRIS MACHINE WORKS
BALDWINSVILLE, N. Y.
Offices in Principal Cities

26 floor-level tanks with a total capacity of 11,400 gal. Thinners are weighed in a scale tank and colors added as required. Turbine-type agitators are driven by separate motors on each tank to permit individual shut downs. The control laboratory was placed on this floor to facilitate checks on color, gloss, drying time, consistency, weight and flow.

On the first floor, mobile paint-filling machines may be set up under any one of the thinning tanks. A portable Sharples centrifuge filters all remaining fine particles from enamels and automotive finishes. It is attached to a thinning tank and empties into a portable tank for filling containers. Maximum safety precautions for workers have been observed throughout the plant. The new unit will be under the general supervision of James L. Caruth, manager of the Pacific Coast branch, and L. A. Thompson, production manager for the Pacific Coast. Southern California manager is Harry S. Irwin and C. E. Campbell is factory superintendent.

The three-and-a-half-story building should mean lots of extra paint for consumers in the Los Angeles area. In the future, however, the firm is sure that demand will require another expansion. Sure enough, at least, to set aside an equal amount of space directly north of the present site.

Soil Neutralizing Is New Use for Sulphuric Acid

A BRAND-NEW use for sulphuric acid —acidulation of alkaline soils—seems to be growing by leaps and bounds. Although it has been used for only three crop seasons, some 8,000 acres has already been acidulated in California's San Joaquin and Imperial Valleys, in addition to small acreages in Arizona and Nevada. It looks likely that this acreage may double each year for several years (naturally the tonnage of acid used will not increase at the same rate). Acidulation by H_2SO_4 was first tried about 20 yr. ago; improper application at that time discouraged further work and until recently.

In the initial neutralization of alkaline soils, usual technique is to treat once with enough acid to bring the soil pH down to about 8, flood the field to wash out neutral salts, then plant. Dosages range from 300-2,000 lb. of 66 Be. acid per acre. The acid is usually sprayed undiluted from trucks, especially on virgin soils. Current applied costs are $37-100 per ton. In following treatments, dosages are usually 100-300 lb. per acre, depending upon the alkalinity. The acid is also fed directly into irrigation water,

THIS RIC-WIL *Copperclad* LINE GOES OVER THE TOP...

Foilclad Units for 63 ft. riser were connected on ground and hoisted into place.

TO IMPROVE STEAM SUPPLY

To meet operating demands for an adequate supply of process steam the engineers of Canada Packers, Ltd., Toronto, installed this new over-the-top steam line. Made up of 550 lineal feet of 8 inch pipe, it is designed to carry 80,000 pounds of steam per hour at 150 psi, 366°F.

The line connects to a supply system running underground and rises vertically to form a huge expansion loop supported on the roof. Desired flexibility is obtained by shaping the structure to conform with roof contour and changes of roof elevation. The vertical pipe tangents absorb horizontal movement of the line due to expansion, while horizontal tangents perform a similar function with respect to vertical movement.

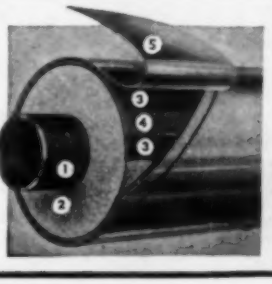
As specified, Ric-wiL pre-fabricated, pre-insulated Copperclad Piping was furnished in 21 foot tangents and elbow units, minimizing field erection costs. Ric-wiL sub-assemblies were scientifically designed to allow for pipe expansion and contraction, thus adding to the flexural properties of the system.

The Ric-wiL Copperclad Piping employed in this installation combines pipe, insulation, high temperature asphalt and spiral wrappings of asbestos felt and copper sheeting into thermally efficient units which are corrosion resistant and fully protected against the elements. This Ric-wiL construction is positive assurance of outstanding durability and long life with minimum upkeep and maintenance cost.

For complete information on this installation and Ric-wiL Foilclad Piping write: The Ric-wiL Co., Cleveland, O., Dept. 1589

FOILCLAD CONSTRUCTION

1. Pipe as specified
2. Insulation
3. Double Coating of High-Temperature Asphalt
4. Asbestos Felt, Tension Wrapped
5. Copper or Aluminum Foil; Tension Wrapped



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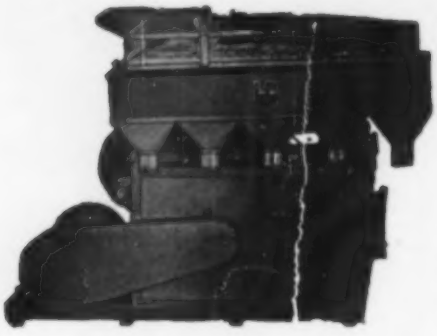

You cannot use wet tables or use flotation reagents on half-inch particles . . .

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You cannot separate by wet tables or flotation reagents round from flat particles . . .

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You cannot size needle-like crystals with screens.

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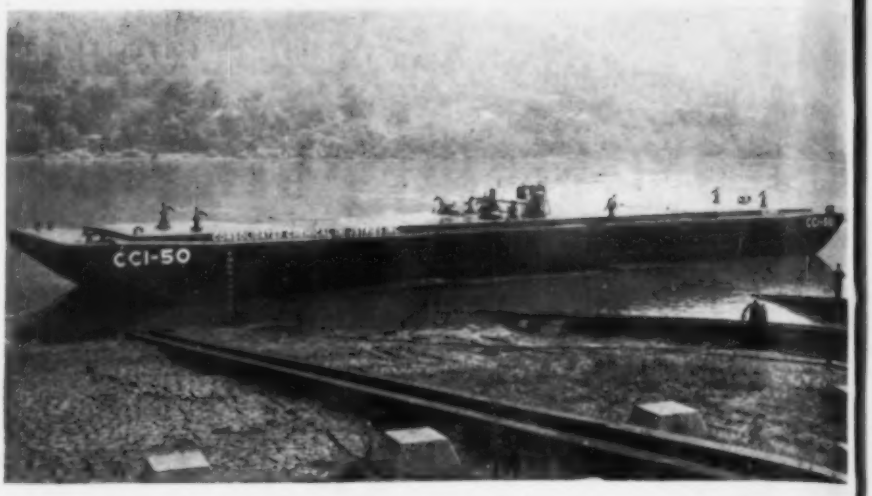
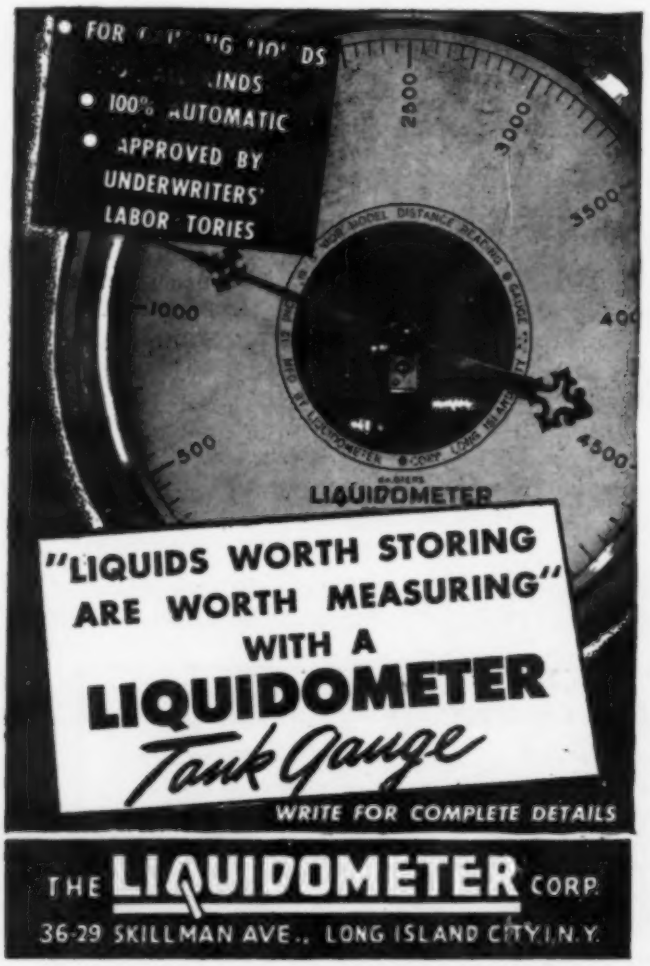
THE PROCESS FOR BETTER PRODUCTS—FASTER



To beat high rail rates, Consolidated Chemical Industries, Inc., has put this new barge to work hauling sulphuric acid on the Intercoastal Waterway.

especially when used on growing crops. Although a small amount of refinery spent alkylation acid is used, most of the H_2SO_4 is virgin acid from the plants of General Chemical Co. and Stauffer Chemical Co.

Results have been outstanding on such crops as alfalfa, grains, grass, cotton and legumes. In the case of alfalfa, there are instances where the use of 1,000 lb. of acid per acre increased the yield about 20 percent per cutting. The acid evidently releases the nitrogen and potash bound up by the high alkalinity. Yet it must be considered as a supplement rather than a substitute for good fertilizer programs. It also increases the rate of water penetration into the soil. In some irrigated fields, the time necessary for penetration has been reduced from 30-36 hours to about 8 hours. Other advantages claimed for H_2SO_4 as a soil acidulant: (1) its ready avail-



For exacting chemical control, from raw materials to finished products, industrial laboratories the nation over depend on B&A Reagents for precision analyses.

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This constant compliance with the purity standards established by the chemical profession itself sets B&A Reagents apart. It gives them the extra margin of quality that so many careful chemists recognize. No wonder they say: "There *is* a difference in reagents. . . . That's why I specify B&A for my work."

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ability; (2) quick action—accomplishes in 24 hours what certain other acidulants may do in 2-3 years; (3) ease with which it can be applied.

Army Ammonium Nitrate Plant Facilities Move to Texas

WASHINGTON sources report that the Army is recalling from the War Assets Administration the two lines of anhydrous ammonia production equipment now at the Louisiana Ordnance Works, Louisiana, Mo. The equipment was declared surplus and WAA was getting ready to sell it, when the Army decided to move the equipment to its San Jacinto Ordnance Depot, on the ship channel near Houston, Tex.

The plant is to be operated for the Army by the Hercules Powder Co. The output of the plant, when erected and in operation again, will go entirely to the Army, which is exceedingly anxious to boost its nitrate fertilizer production for shipment to the occupied areas.

The equipment has a capacity of about 70 tons a day of anhydrous ammonia. It consists of gas reforming furnaces, compressors, gas purification equipment, converters, and other equipment such as pumps and recirculators. Plans are being considered to transport more than half the equipment by barge all the way from the present site to the new site.

The Missouri Ordnance Works Plant, now operated by the Bureau of Mines to further its synthetic fuel research, keeps three other anhydrous ammonia production lines. Bureau of Mines didn't need all five lines when it took over the plant.

Nuclear Research Gets Heavy Water From Trail

MOST of the heavy water used in American and British research on atomic energy is produced at the giant works of Consolidated Mining & Smelting Co. of Canada, Ltd., at Trail, B. C. Although production has been under way for several years, this fact was publicly released only recently.

The process is essentially that developed by H. S. Taylor of Princeton University, R. H. Crist of Columbia University and H. R. Arnold of Du Pont. It consists of passing hydrogen and steam over a catalyst bed and upward through a large packed rectangular tower countercurrent to a flow of ordinary water. The catalyst removes heavy water from the gases; the ordinary water absorbs it. Bottoms of the first tower are given similar treatments in a series of towers

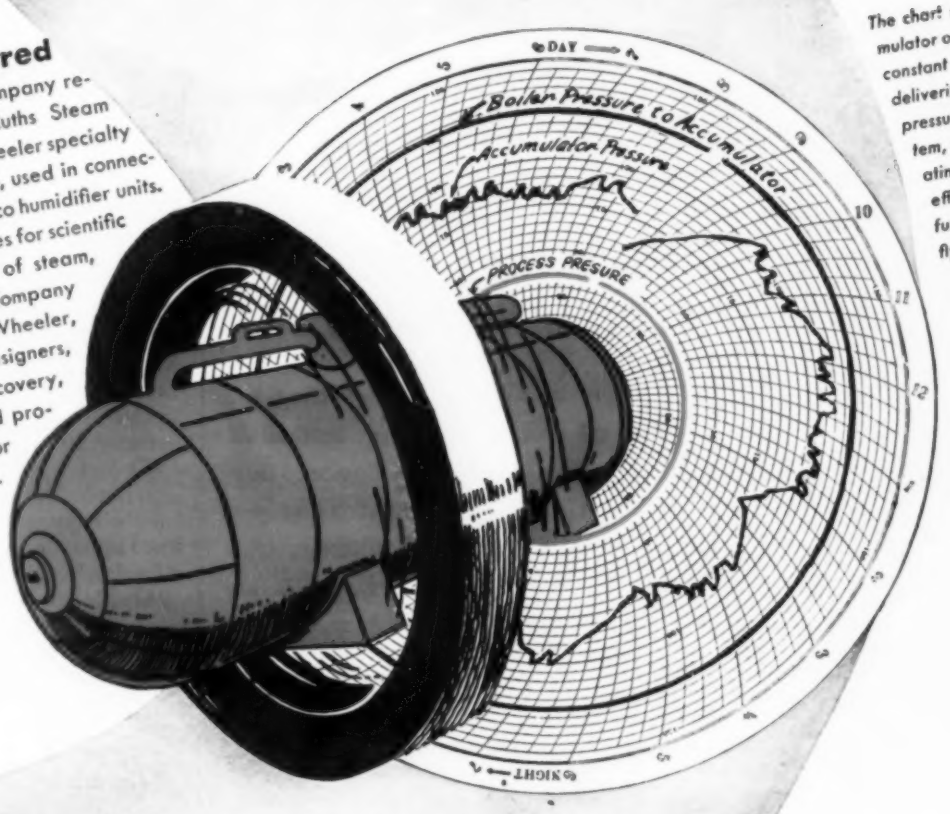
MOISTURE CONTROL

the scientific way

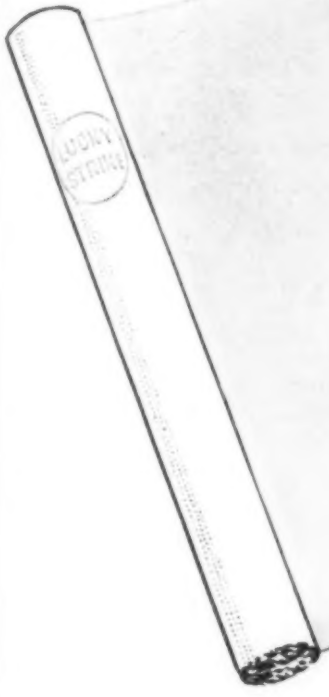
third unit ordered

The American Tobacco Company recently ordered another Ruths Steam Accumulator—a Foster Wheeler specialty—making a total of three, used in connection with a group of tobacco humidifier units.

In expanding its facilities for scientific conservation and control of steam, The American Tobacco Company again calls on Foster Wheeler, leading engineers, designers, and builders of heat recovery, steam generating, and processing equipment for over a half century.



The chart shows how the accumulator operates to maintain a constant boiler pressure while delivering steam at constant pressure to the process system, despite widely fluctuating demands. Thus, in effect the accumulator functions as a "thermal flywheel".



stores surplus steam—insures constant pressure

- Supplies steam to the process system at rates greatly in excess of the output rate of the boiler plant.
- The use of an accumulator reduces the number and size of boilers required for a given installation.
- An accumulator insures constant steam pressure, maximum efficiency and capacity in both power generation and process work.
- Entirely automatic in operation.

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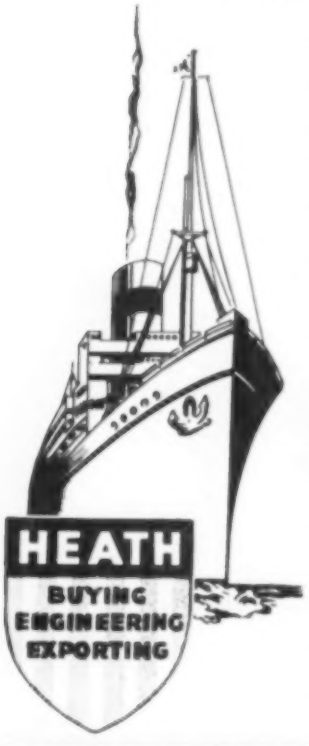

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and become progressively richer in heavy water content.

Although only a small quantity of heavy water is made, considerable equipment and huge quantities of electric energy and water are necessary. Trail was chosen as site of the plant since it had the necessary quantities of raw materials, electric energy and equipment as well as technical experts and inaccessibility.

Idaho to Get Phosphate Fertilizer Plant

FERTILIZER developments in the West are making the headlines again. Recent moves center in the Intermountain area where large deposits of phosphate rock are available. The logic is obvious: Western demands for phosphate fertilizers have skyrocketed in recent years.

By next year you can add another phosphate producer to the list: Gates Brothers, Inc., of Wendell, Idaho. This firm now has a single superphosphate unit under construction at Wendell; acidulating equipment is being installed and the plant is expected to be ready to produce by January 1949.

Orders have also been placed on equipment for a phosphoric acid unit and a triple superphosphate plant at the same location, states president Charles T. Gates. These plants will probably not be able to produce before April or May of next year; deliveries of equipment will determine the date. Output of H_3PO_4 will be used solely for the firm's triple superphosphate operations. Initial investment is placed at $1,500,000. Capacity of the grinding plant for single and triple superphosphates combined will be 300 tons daily. For the present, only straight phosphate fertilizers will be made.

Alaskan Pulp Will Be Made By Puget Sound Subsidiary

THE United States Forest Service had long been interested in opening the door to Alaska's large timber reserves. It was influenced by a paper shortage during the war and by a desire to remedy the region's peculiar employment situation caused by seasonal fishing. But when Congress last year authorized sale of several timber stands the Service found no takers. Biggest obstacle was the threat of ownership claims by Alaskan Indians.

Key that turned the lock came in the form of a bill passed by the 80th Congress: proceeds from timber sales will now be held in a special fund until claims are adjusted. In an offering made last month, Ketchikan Pulp

SHELL CHEMICAL now synthesizes

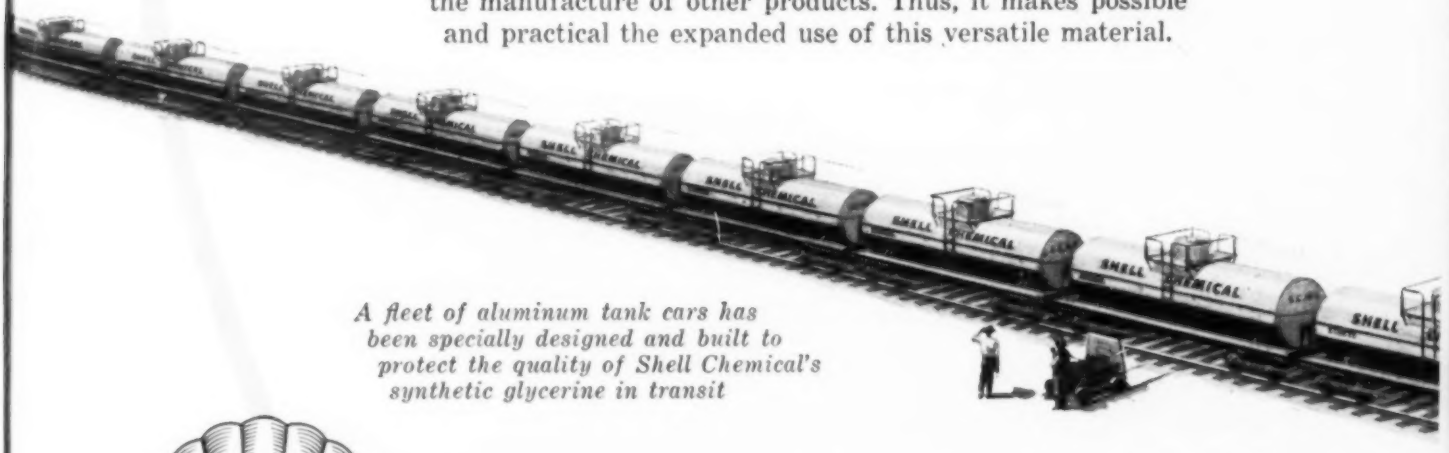
Glycerine

...in quantity

A unique **Shell** Chemical process is now used to *synthesize* glycerine! Springing from years of fundamental research, the process is based on a chemical reaction long thought to be impossible . . . the chlorination of propylene gas to form allyl chloride. Its raw materials are plentiful—chlorine, caustic soda, propylene. And its result is glycerine of the highest quality.

The plant is now on stream at Houston, Texas, producing and shipping tank car quantities of glycerine . . . helping to fill the urgent needs of products ranging from paints to cellophane to high explosives.

For industry this Shell Chemical process provides a new source of high quality glycerine . . . free from dependence on the manufacture of other products. Thus, it makes possible and practical the expanded use of this versatile material.



A fleet of aluminum tank cars has been specially designed and built to protect the quality of Shell Chemical's synthetic glycerine in transit

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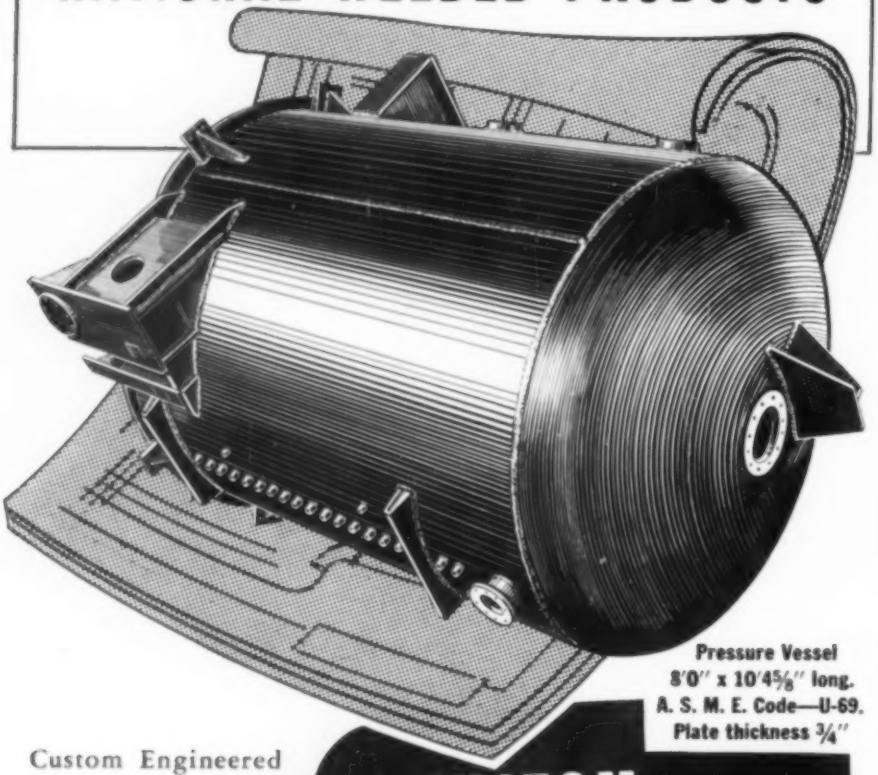

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8'0" x 10'4⅝" long.
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WASHINGTON, PENNA.

& Paper Co. became successful bidder on 1.5 billion cu. ft. in southeastern Alaska's Tongass National Forest. The firm is controlled by Puget Sound Pulp & Timber Co., long interested in Alaskan pulp. A plant site was recently purchased near Ketchikan and plans for a $20-30,000,000 mill capable of an initial production of 300 tons of dissolving pulp daily are being formulated. Associated with Puget Sound in ownership of the firm's common stock is American Viscose Corp., large consumer of rayon-grade pulp. Construction is expected to start next summer, with completion in about three years. Lawson P. Turcotte, executive vice president of Puget Sound Pulp, is president of Ketchikan Pulp & Paper.

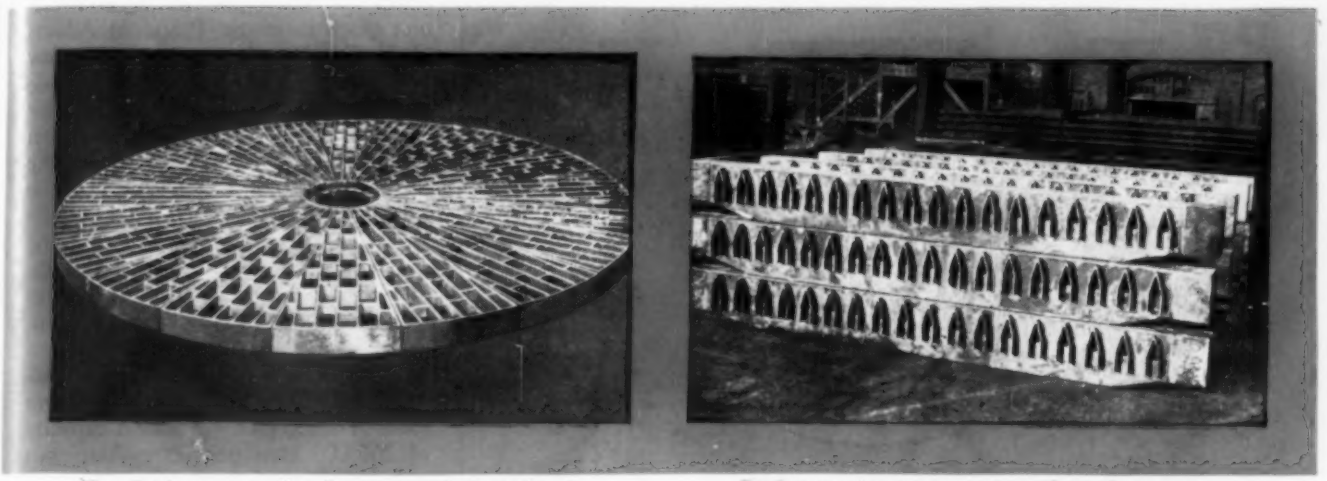
Phillips Broadens Its Chemical Output

Phillips Petroleum Co., Bartlesville, Okla., has plunged into the chemical business in a large way. Already a manufacturer of butadiene and special bydrocarbons and their derivatives, Phillips organized last month the Phillips Chemical Co. and announced plans (1) to build a $6 million ammonium sulphate plant at Houston, and (2) assume operation of and enlarge the capacity of the Cactus Ordnance Works at Etter, Tex., to manufacture anhydrous ammonia. Cactus will also be enlarged by the addition of an ammonium nitrate plant. Phillips was scheduled to take over Cactus this month on a long-term lease from the government.

The lease taken by Phillips Petroleum on Cactus stipulates that the company shall make a substantial investment. Phillips expects to spend about $16 million there and will increase production of ammonia by finishing a partially completed second ammonia line and by moving to the plant nitric acid and neutralization facilities furnished by the Army.

Under the lease the Army is entitled to buy products from the Cactus plant for export until June 30, 1952. Although the Army may buy all or part of the production, a spokesman for the Army says it is thought that the demands on the Cactus output will cease or materially decrease within the next several years. Phillips officials say the company plans to turn the production into the domestic fertilizer market as rapidly as the Army's requirements are reduced.

Phillips Chemical Co. has been designated the organization to centralize the company's chemical activities, and will assume operation of the new ammonium sulphate plant at Houston, Cactus Ordnance Works and the



Ten circular gratings like this were made by B&W to tolerances of + ¼ inch on straightness, + ⅛ inch on length and + 1/16 inch on depth of grooves. Each had twenty 7-foot, 575-lb. sections cast from 25% Cr 12% Ni alloy.

Alloy Air Headers for a catalytic cracking kiln. Cast by B&W and assembled by welding, they have higher allowable stress at elevated temperatures, better oxidation resistance, smaller and lighter sections, longer life; cost less than fabricated headers replaced.

CAST to LAST

in high-temperature service

Vital to many different kinds of process equipment, B&W Alloy Castings are demonstrating outstanding ability to resist abrasion, corrosion and oxidation, and to retain great strength at elevated temperatures.

Operating in about every kind of tough service, they are helping to keep production up by reducing costly, time-consuming repairs and replacements. Their long-life characteristics have been proved over and over in service temperatures up to 2000 F, and under conditions requiring high creep strength, consistent with long-term stability.

From its own modern foundries, B&W can supply alloy castings in practically any weight and shape required, and from a wide range of analyses.

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company's synthetic rubber and carbon black interests. President Adams of Phillips Petroleum Co. said a few weeks ago that the company has made an acceptable offer to War Assets for the idle Todd Shipyard property on the Houston ship channel and that the property will be the nucleus of the company's chemical activities on the Gulf Coast. Phillips officials say the new projects which the chemical company is assuming are but the nucleus of a long-range chemical manufacturing program.

Construction of the ammonium sulphate plant at Houston was to begin soon. The project will have a capacity of 266,000 tons per year. Ammonia will be supplied from production of the Cactus Ordnance Works which has a present annual capacity of 70,000 tons. Phillips will increase this capacity to 140,000 tons, one-half of which is earmarked for the plant to be built at Houston.

Officers of the Phillips Chemical Co. include Frank Phillips, chairman; K. S. Adams, president; R. W. Thomas, executive vice president; Don Emery, G. G. Oberfell, Paul Endacott and R. C. Jopling, vice presidents; and G. W. McCullough, vice president and general manager.

Third National Plastics Show Coming to New York

READY to present an exposition far more comprehensive than its two previous offerings, the Society of the Plastics Industry will stage its Third National Plastics Exposition in Grand Central Palace, New York, Sept. 27-Oct. 1. It is being planned as a purely trade and industrial show, emphasizing recent strides made by the plastics industry in a number of hitherto unexplored fields, also the industry's possibilities for future growth and expansion. The outlook is bright largely because so much among the hundreds of products to be displayed and processes demonstrated, is new or recently improved. "Progress with Plastics" is the slogan of the exposition.

With the exhibitors list including most of the widely known companies producing basic plastics materials, such as Dow, Bakelite, American Cyanamid, Monsanto, Du Pont, Celanese, Catalin, Owens-Corning Fiberglas, Durez, B. F. Goodrich, Goodyear, Hercules Powder, Tennessee Eastman, and Libby-Owens-Ford, a spectacular display may be looked for. In addition to these, there are a number of old line and new companies prominent in industry and important because of the end products and machinery they will show. All of the fabricating processes —low pressure and cold molding, ex-

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NEEDLE VALVES
SAUNDERS-TYPE VALVES

For extra safety in difficult process applications

Kieley and Mueller Reverse-Action Diaphragm Motors were designed for use with Saunders-type chemical valves, needle port valves, and Milflo control valves where reverse-seated construction is impractical. The exclusive Neoprene "O" ring design provides a positive seal and eliminates stuffing box friction.

In the K&M Reverse-Action Diaphragm Motor there is no loss in effective diaphragm area, no loss in available stroke, no difference in spring rate. Direct or reverse acting — size and efficiency are identical.

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truding, bonding, coating, calendering, low pressure laminating, cast resins, new applications of infrared techniques, and others will be demonstrated.

The show will reveal how recent years have developed, some by trial and error, durable, serviceable plastic products and have eliminated certain ones found unsuitable for the purpose used. More and more the combination of plastics with wood, metal, paper and other substances will be noted.

Chemical Combination Gives Single-Shot Treatment

Cotton growers formerly lost about one bale in seven of their production through insect damage. A new chemical combination is believed effective to provide an all-insect killer which will eliminate a large part of this loss more effectively than old-fashioned calcium arsenate and nicotine. The new recommended formula contains DDT, chlorinated camphene, and benzene hexachloride. Extensive use this year is proving the formula. Very general use next year is forecast by the Department of Agriculture if this year's results are as good as they are expected to be.

ECA Acts as a Banker In Allocating Funds

Dealings of American industry with ECA convincingly disclose that this new relief agency is essentially a banking firm. All of its procedures for screening applications from abroad resemble those of a banker undertaking to determine whether the applicant for money will put the funds to good use if he gets them.

Process industries, which will supply a substantial part of relief materials, find in Washington a screening procedure that assures business dealings directly between seller and foreign or specialized purchasing agent. ECA is not the buyer. It merely determines where funds will be allotted and for what commodities under what conditions for spending in specified countries, or in the United States.

The first billion dollars of relief funds was allocated by ECA before August 10. The goods and services for which this amount will be spent include some, but not many, chemical commodities. Boiled down to simple form, the allocations were for the following quantities of goods measured by millions of dollars allocated: Wheat and flour, $277 million; other foods, $123; coal and petroleum products, $174; cotton and textiles, $106; metals

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The four sources of supply and service indicated above add another Foxboro *plus value* to the advantages of these unique process control valves. Each source is equipped to assemble Stabilflo Valves in a variety of sizes and materials to meet most specific needs . . . and staffed by expert application engineers and valve specialists.

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5. *High force-friction ratio—negligible hysteresis*
6. *Vibration resistant*
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9. *Renewable seat rings*

Compare Foxboro Stabilflo Valves point for point with other valves: (1) perfect response to every impulse of the controller; (2) minimum maintenance; (3) unequalled service. Write for Bulletin 272-2. **The Foxboro Company, 60 Neponset Avenue, Foxboro, Mass., U. S. A.** Branch offices in principal cities.

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In handling liquids and semi-liquids, install ILLINOIS porcelain pipe and fittings for a permanent means of handling materials.

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3. Illinois porcelain pipe prevents wet spots caused by condensation.

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★ *Quality Control*
No changes in composition of material during its handling in the plant.

★ *No Electrolitic Action*
Non-absorbent porcelain does not pick up minerals or metals in material being handled.

★ *Production Cost Savings*
Corrosion-proof porcelain cuts maintenance. Spoilage in materials is reduced because porcelain is permanent.

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CHEMICAL
ILLINOIS
ELECTRIC PORCELAIN CO.
MACOMB, ILLINOIS

and machinery, $102; chemicals and related products, $55; lumber, $30; tobacco, $22; other goods, $15; and freight, $96 million.

Shell Brings More Units On Stream at Houston

FACILITIES for the manufacture of methyl ethyl ketone and secondary butyl alcohol have gone into production at the Houston plant of Shell Chemical Corp. The production at Houston will increase the company's capacity to produce these products by 150 percent. Shell has been previously manufacturing the chemicals at Martinez, Calif., and Dominguez, Calif. The ethanol unit was also completed last month.

The new facilities at Houston are part of a $43 million expansion program undertaken by the company in 1946. Most of the program is centered at Houston, where a two-day celebration this month marked the completion of the commercial-scale synthetic glycerine plant. It is the first of its kind in the world. It is expected that the entire program will be finished some time this year.

Humble Gives Go-Ahead on Research Expansion

SINCE announcing last month a projected new centralized petroleum research building at its Baytown, Tex., refinery, Humble Oil & Refining Co. has definitely decided to build the structure. Contract for approximately $1 million has been let to the Knutson Construction Co. of Houston. Architects are Voorhies, Walker, Foley and Smith.

The air-conditioned, three-story building will be probably completed late next year. It will consolidate most research work at the refinery and will house about 115 scientists. Laboratories, offices and a complete research library will be included in the equipment.

Anaconda Expanding Its Acid And Superphosphate Output

PRODUCTION of superphosphate fertilizer is nothing new at the huge smelter of Anaconda Copper Mining Co., Anaconda, Mont. Using sulphuric acid made from smelter gases, the firm has treated Idaho phosphate rock since 1923. Current output is 5,500 tons of 53 percent P_2O_5 phosphoric acid and 60,000 tons of high-grade superphosphate fertilizer annually.

Late last year action was taken

FOR... Acids

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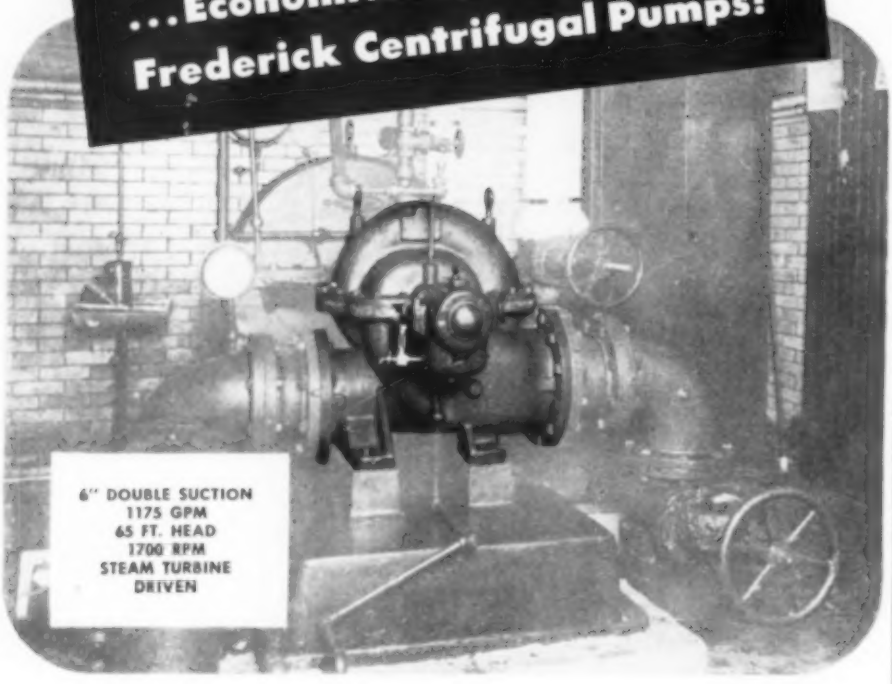
...Economical operation from Frederick Centrifugal Pumps!



Twenty-nine years ago, Frederick Iron & Steel manufactured its first centrifugal pump . . . a 6" Double Suction Volute type. Delivered in July, 1919, this pump is still in operation today at the Dominion Coal Co. in Sydney, Nova Scotia. Minor repair parts over the 29-year period have been furnished promptly by Frederick. Today, Frederick Iron & Steel is manufacturing a complete line of single and double suction, single and multi-stage centrifugal pumps with the same long-lasting quality built into its first unit. When you buy Frederick pumps you're assured of continuous, economical operation from extra long life.

We have among our designs just the centrifugal pump you're looking for. Drop a line to the address below and we'll gladly send you an attractive, illustrated "file-size" brochure on our pumps as well as the name of our factory representative nearest you. Ask for Bulletin 104.

Frederick

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IRON AND STEEL, INC.

Department P-2 — REPRESENTATIVES IN PRINCIPAL CITIES — Frederick, Md.

ALSO MANUFACTURERS OF FRECUT AND FREFORM METALWORKING MACHINERY, FREDERICK STOKERS AND ASH CONVEYORS AND A COMPLETE LINE OF GRAY IRON CASTINGS.

which will practically double this tonnage. A contact acid plant with a daily capacity of 150 tons of 100 percent sulphuric acid was acquired and is now being erected. The phosphate expansion will involve additional rock calcining, grinding and leaching facilities, Lurgi filters, vacuum evaporators, mixers and superphosphate aging, drying and grinding units. The extension is expected to lift phosphoric acid production to 19,000 tons yearly, and superphosphate to 100,000 tons. The new units are scheduled for operation early next year.

Fire at Butyl Rubber Plant Knocks out Production

HEAVY damage by a fire on August 3 in the finishing room of the government-owned butyl rubber plant operated by Humble Oil & Refining Co. at Baytown, Tex., has probably knocked the plant out of production until late this month or possibly some time in October. Severe damage to the ventilating and electrical systems and other equipment resulted from the blaze. No injuries occurred. The fire developed among wooden trusses that supported the building.

Representatives of the Office of Rubber Reserve in Washington visited Baytown last month to inspect damaged equipment.

Fine Chemicals Plant Under Construction at Chattanooga

TENNESSEE PRODUCTS AND CHEMICAL CORP. is building a plant for the manufacture of fine chemicals at Chattanooga, Tenn., and expects to have the plant in operation early next year. Total monthly output will reach about 425,000 lb. The principal products will be powdered and flake sodium benzoate, technical benzoic acid, technical and f.f.c. benzaldehyde, benzyl chloride, and technical and f.f.c. benzyl alcohol.

Blaw-Knox Co. is the general process contractor. George Bernard & Co., Birmingham, Ala., is the general building contractor.

Power Show Offers Equipment Designed for Economies

THIS year's Power Show will reveal ways to help cut into the inflation spiral at one of its numerous sources. Exhibitors are emphasizing equipment designed for new economies in production, transmission and regulation of power. The display, officially known as the 18th National Exposition of Power and Mechanical Engineering,

5 concrete answers

TO YOUR REFRACTORY PROBLEMS

B&W Refractory Castables—possessing all the easy-to-use properties of ordinary building concrete—are supplying the cost-cutting solutions to many furnace construction and maintenance problems. Five different types are available to cover the wide range of conditions in modern furnaces:

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Type A—a "short" mixture that pours readily and flows into small spaces.

Type B—a more plastic and adhesive mixture for patching purposes.

Use limit 2600F. Bulletin R-1-F.

5 **INSULATING CONCRETE-MIXES** . . . lightweight, highly effective insulating materials ideal for protecting cartops and furnace steel, for lining ducts, etc.

B&W K-20 Concrete-Mix for 2000F service

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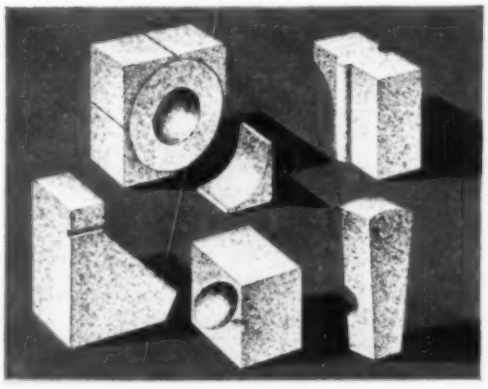
B&W K-20 or K-22 Concrete-Mix for Cement Guns

Bulletin R-19.



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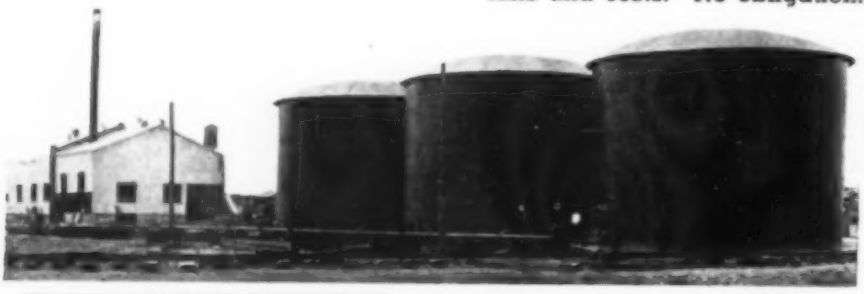

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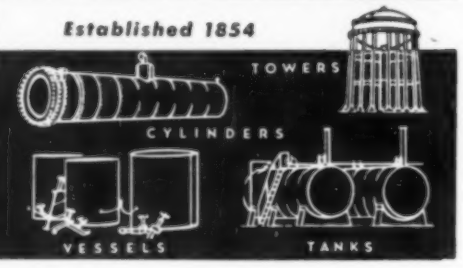
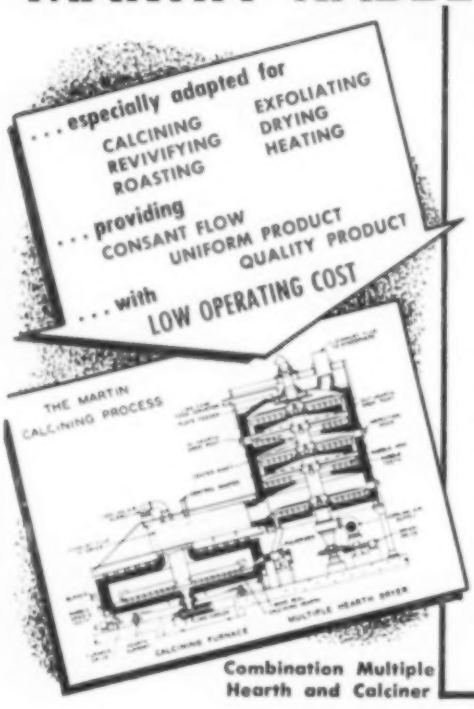


MARTIN RABBLE FURNACES*



Combination Multiple Hearth and Calciner

The Martin Multiple Hearth Furnace is adapted for continuous process rabbling with mass temperatures up to 1800° F. The furnace can be "zoned" for closer control.

The Rotating Hearth Furnace is designed for continuous rabbling, carrying material bed temperatures 1800° F and higher. Special designs can be provided for rabbling up to 2500° F. The unit is especially adapted for reburning of lime, high temperature rabbling of pigments and similar materials where a dust condition would otherwise be troublesome.

This Martin Furnace is capable of considerable flexibility. Why not look into the merits of this furnace for your processing?

*Patents and Patents Pending

Martin Furnace Division
MORSE BOULGER DESTRUCTOR CO.
211-A East 42nd St. New York 17, N. Y

will occupy four floors in Grand Central Palace, New York, November 29 to December 4.

Exhibits will range from the fire box to the pushbutton on the last motorized units of a plant. New economies will be reflected in piping and valves, automatic recorders and controls, as well as instruments for many purposes. Improved construction will be featured in pumps, compressors, fuels and materials handling equipment; variable transmissions and drives as well as other kinds of power and power plant machinery.

Crossett Expands Paper Unit in Arkansas

Crossett Lumber Co., Paper Division, Crossett, Ark., has begun an expansion program which will materially increase its manufacturing capacity. The digester building will be enlarged in order to house three additional digesters. A two-story personnel building will be erected to accommodate 900 men. Construction is scheduled to begin this fall on an expansion of the existing paper machine building to accommodate a 210-in. machine for manufacturing light weight kraft paper.

Imperial Sets Up Salt Plant Near Houston

Imperial Salt Co. is putting into operation this month a salt evaporation plant on the Blue Ridge dome a few miles outside Houston and will produce between 100 and 150 tons per day of purified and crystallized salt for industrial and edible purposes. The brine, produced by injection of fresh water into the salt dome, is processed in a Manistee triple-effect evaporator after chemical treatment.

R. T. Cowan is president, and M. G. Wogan is vice president and sales director, of the new company.

Public Lands Held for Uranium Drilling

About 115 square miles of public land in Colorado and Utah have been withdrawn by the government from public entry in order to permit an intimate survey of possible uranium occurrences. A thorough study of this area and some diamond drilling for uranium bearing ores is to be started promptly. Land will be released as soon as the absence of uranium has been determined. Meantime private interests can operate in the area only under special arrangement, usually not at all.

Your choice of 1, 2, 3, or 4-lamp

Fluorescent Lighting Fixtures in the **complete**

CROUSE-HINDS

line . . . . designed to meet your requirements

EASY INSTALLATION

Crouse-Hinds Explosion-Proof Fluorescent Lighting Fixture CONDULET* has a novel hinge connection between the lamp receptacle housing and the ballast housing that makes it unnecessary to raise and attach both ends of the fixture at the same time. With the tubes hanging straight down, the ballast end is connected to the supporting CONDULET. Then the relamping end is raised and attached, bringing the tubes to a horizontal position.

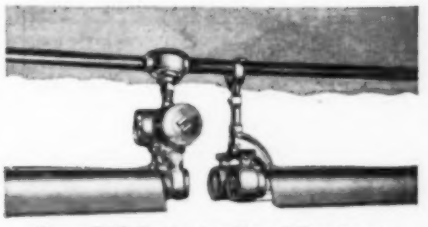
EASY MAINTENANCE

Relamping is a quick and easy one-man job. No special tools are required. Moving a link in the supporting stem assembly permits one end of the fixture to be lowered so that the lamp can be withdrawn. After relamping, simply lifting the lowered end automatically locks the fixture in its normal position. Saves time and money on maintenance.

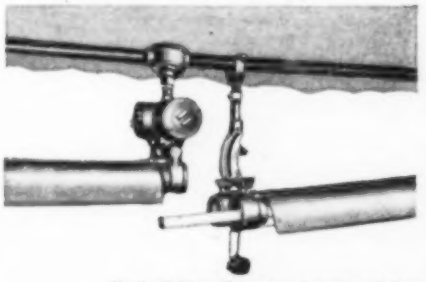
QUALITY CONSTRUCTION

The ballast and lamp receptacle housings are of cast aluminum with unobstructed threaded covers to allow easy access to the interior. Each lamp is housed in an individual heat-resisting glass tube. The ballast housing is entirely exposed, resulting in a low operating temperature. The durable white enameled sheet steel reflectors are securely attached by spring clips. No tools are required to put them on or take them off after the fixture has been hung.

Write for full details on this modern Explosion-Proof Fluorescent Lighting Fixture CONDULET.



Type EVF Explosion-Proof Two-Lamp Fluorescent Lighting Fixture CONDULETS Installed in Line Close Together



End of One Fixture Lowered for Relamping, One Cover Removed and Lamp Partly Withdrawn

Takes standard 40-watt, 48-inch lamps.

*CONDULET is a coined word registered in the U. S. Patent Office. It designates a product made only by the Crouse-Hinds Company.

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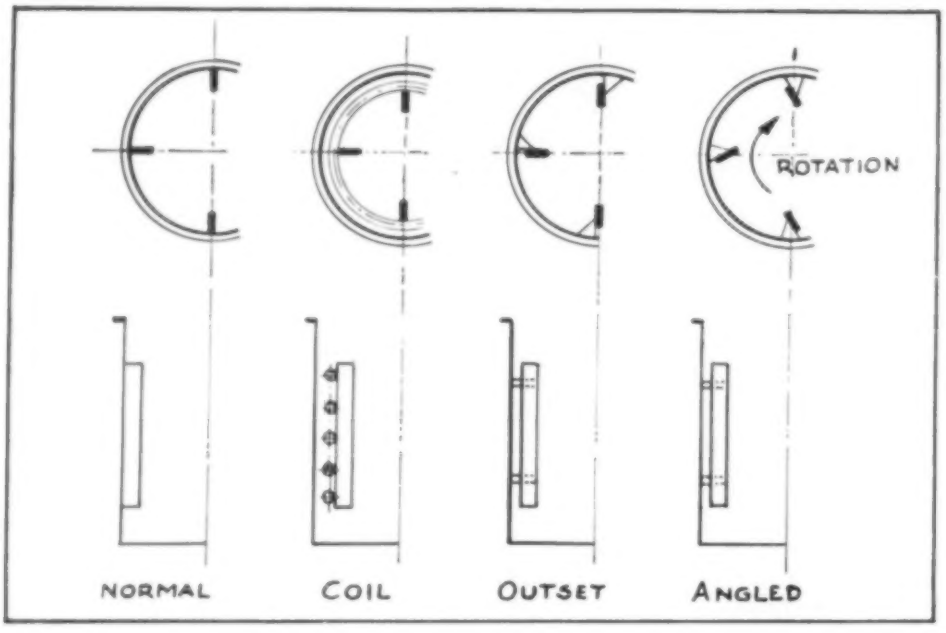

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NEWS FROM ABROAD

Special Correspondence

Synthetic fuels program for India . . . Phillips builds British carbon black unit . . . Australians fighting alkali duty . . . Saint-Gobain reports on progress.

India Plans Large Synthetic Fuel Program

KOPPERS CO., Pittsburgh, has two teams of technical experts in India rushing surveys on important government industrialization schemes which run into millions of dollars.

One group has just arrived to complete before September a plan for the establishment of a state-owned synthetic petroleum industry based on the gasification of low-grade coal. The study is to be based on costs of a plant to produce either 100,000, 250,000, 500,000 or 1,000,000 long tons of gasoline and byproducts.

Preliminary estimates are that a 1,000,000-ton plant, India's favorite, would cost roughly $150 million plus the outlay for a 200,000-kw. power station.

The other group is rushing alternate plans for doubling of India's steel capacity to 2,000,000 long tons annually. One plan calls for two 500,000-ton plants, the other for a single million-ton unit. On this job Koppers is to share with Arthur McKee & Co. and Britain's International Construction Corp., the complete design, engineering supervision and pilot operation of the facilities.

Final plans are to be submitted within six months. Meanwhile, preliminary estimates are that two 500,000-ton plants would cost $225 million each and a 1,000,000-ton plant $480 million.

Phillips Will Build Carbon Black Plant in England

AN AGREEMENT has been concluded between British and U. S. interests for the manufacture of carbon black in Great Britain. Official approval has already been obtained, and the requisite licenses for the acquisition of a suitable site, erection of buildings and installation of plant are expected to be granted soon.

The interested parties are, on the British side, the Palatine Development Co., a joint subsidiary of Gas Consolidation Ltd. and Severn Valley Gas Corp., and, on the American side, Phillips Petroleum Corp., Okla. Although the British gas industry has been nationalized, Palatine Development Co. will remain in private hands, and the capital required for the new carbon black plant will also be raised privately.

Carbon black was not hitherto made in the British Isles. Virtually all requirements were met by supplies from the United States. The new plant, according to unofficial reports scheduled to produce up to 25,000 short tons annually, will probably be located near Liverpool through which port most of the U. S. carbon black is being imported now.

Under Phillips patents Philblack A and C are to be made in the new British plant, and Philblack O, the new high abrasion furnace black, may also be produced.

Wool Grease Derivatives Made at Australian Plant

FELT & TEXTILES OF AUSTRALIA, LTD., and twenty-odd other Australian wool concerns have been jointly developing the lanolin and wool grease industry over the last five years. A chemical subsidiary, Lanreco Pty. Ltd., was established by Felt & Textiles to exploit these byproducts in all states.

Lanreco claims to have succeeded in producing chemically pure cholesterol from lanolin even before production got under way in the U. S. and Europe.

Research work on the recovery of byproducts of greasy wool, including wool wax alcohols, cholesterol and other special fatty acids, has been conducted in conjunction with the research laboratories of Felt & Textiles.

Lanreco has been exporting large quantities of superfine lanolins (recovered from pure merino wools) as well as commercial and crude wool greases during the last few years and is now pushing the export of more valuable byproducts such as cholesterol. These are made at a pilot plant in Sydney.

India Sets Linseed and Oil Export Quotas

LINSEED and linseed oil export quotas for 1948 have recently been finalized by the Indian government. Shipment of 11,251 metric tons of seed and 3,352 metric tons of oil is permitted.

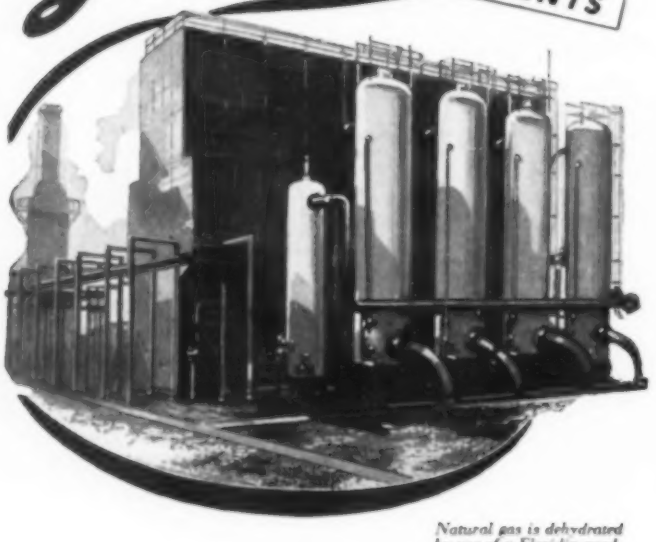
Of these totals, more than half of each is earmarked for Great Britain which will receive 6,000 metric tons of seed and 2,000 metric tons of oil. Only other recipients of importance are Egypt with 2,100 metric tons of seed, and Switzerland with 1,425 metric tons of seed and 475 metric tons of oil.

Austrialian Firms Fighting Alkali Duty Down Under

SEVERAL Australian firms have joined in an application to the Department of Trade and Customs to permit the duty-free entry of caustic soda and other heavy alkalis. The $16-per-ton impost, which enables the locally produced hydroxide to be sold far above world parity, is opposed particularly by Monsanto's Australian branch plant, Timbrol Ltd., Beetle Elliott Plastics and other industrial users of the chemical.

Many industries are also affected by the continued shortage of heavy alkalis. Australian Consolidated Industries, Australia's glass and ceramic combine, annually uses 40,000 tons of soda ash, but only 17,500 tons are available from Australian plants. Sup-

Floridin
ADSORBENTS



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File them for ready reference

FLORIDIN COMPANY
ADSORBENTS
Department A, 220 Liberty St. Warren, Pa.

plies from Britain have been falling off since the war.

Practically the only producer of heavy alkalis in the Commonwealth is Imperial Chemical Industries of Australia and New Zealand. ICIANZ's Osborne, South Australia, ammonia-soda plant has a capacity of 35,000 tons of soda ash, 8,000 tons of caustic soda and 6,000 tons of bicarbonate of soda annually. Work is in hand to double the capacity of this plant except for bicarbonate.

Two electrolytic hydroxide plants at Botany Bay, near Sydney, have a combined capacity of 7,000 tons. One other electrolytic plant is operated by Associated Pulp & Paper Mills Ltd. at Burnie, Tasmania.

As byproduct of the electrolytic operations ICIANZ bottles 6,800 tons of chlorine a year, of which 4,100 tons is used in the production of bleaching powder, DDT, and other chlorine compounds.

Australian demand for soda ash is running 70,000 tons a year. ICIANZ is producing rather less than half this amount at present. Consumption of caustic soda is estimated at 20,000 tons annually, but ICIANZ does at present supply only about one-quarter. Supplies of bicarbonate of soda, calcium chloride and liquid chlorine are also insufficient.

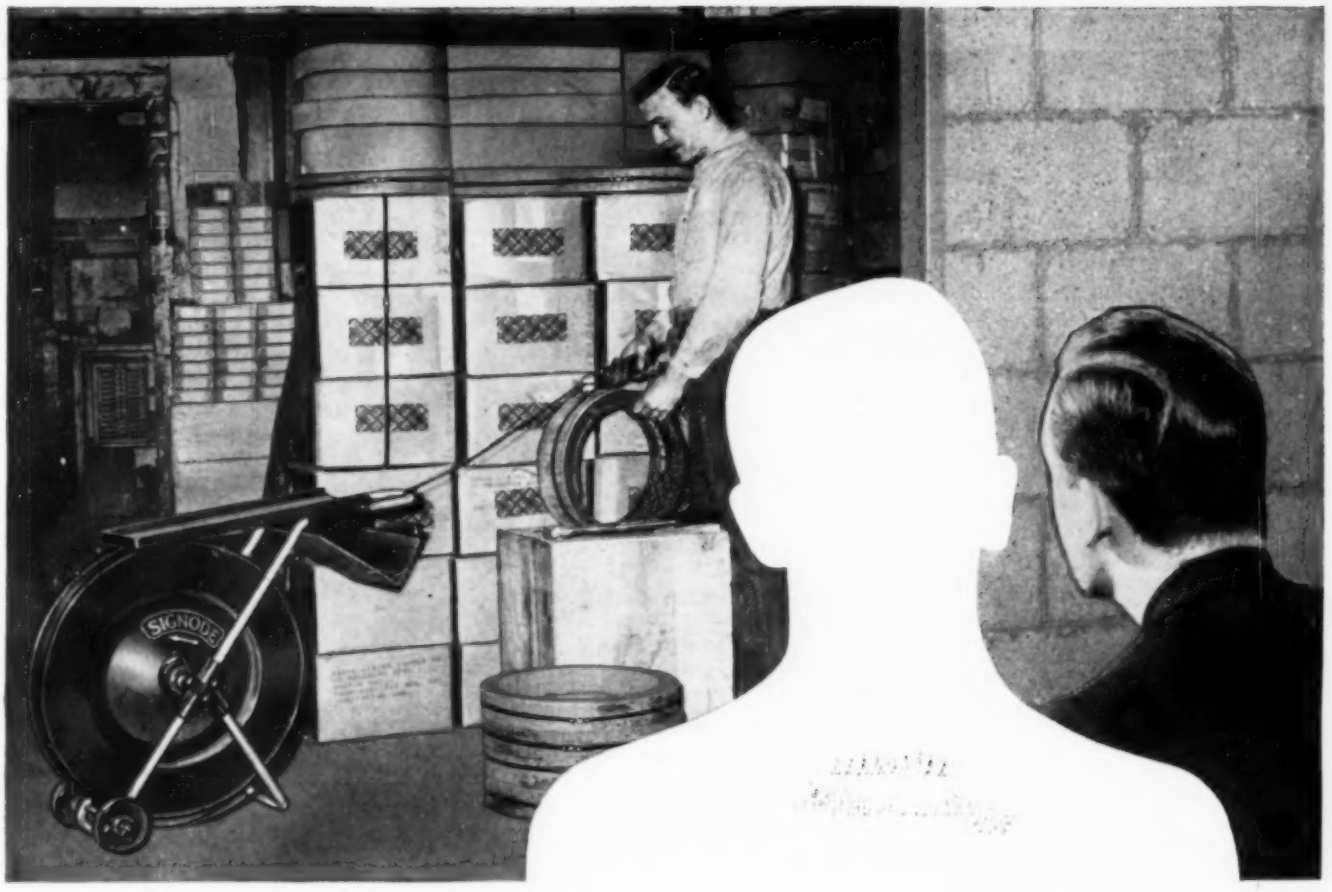
Soviets Pushing Studies On Luminescence

SOVIET luminescent lighting experts are steadily expanding the range of practical applications for luminiscence or "cold light." Latest applications here include use of luminiferous compounds to test the quality of metal ware, output of cotton cloth colored with luminous dyes, use of luminous paints in pictorial art, creation of new luminifers described as superior to foreign "cold light" emitters, and production of vari-colored luminescent bulbs.

These new developments in Soviet luminiscence are currently being demonstrated at a special exhibit organized at the Moscow House of Scientists in connection with a national conference on the subject. The lighting effects and uses on demonstration are briefly as follows.

Liquid luminous compounds are used in testing metal objects. The metal part after being cast is immersed in the compound, removed and permitted to dry; then placed under the rays of a quartz lamp. The luminous material that penetrates into microscopic pores of the metal readily discloses defects invisible to the eye.

Used in coloring cotton cloth, the



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- Special consideration is given to the best type and speed of agitation.

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Agitated Reactors are only part of the complete I★P★E line of "Standard-Plus" processing and mixing equipment and agitators. For more information about . . .

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5200 HUDSON AVENUE, WEST NEW YORK, N. J.

luminous dyes lend the goods an ornamental quality under daylight, while in darkness they take on diverse new tones, the patterns glitter like gems.

Pictures executed in luminous paints are exhibited on the walls of the hall, glowing in the semi-darkness. Soviet artists are doing some interesting work in this new field, most representative of which is the huge 220 sq. ft. portrait of the classic Uzbek poet Alisher Navoi, that was made by the Soviet Art Committee's experimental laboratory of luminescent decorative painting in Moscow, and sent to Tashkent where it will be installed as a wall decoration in the city's new Opera House.

New luminifers created in the USSR Academy of Sciences and at research laboratories are finding increasingly wider application in industry. They are described as "superior to foreign luminous compounds in quality, brightness and duration of light emission."

The Moscow electric bulb factory has in production a great variety of luminous bulbs of diverse color and power: daylight white, blue, tender pink, golden and green. The factory products on exhibit also include electron-ray tubes with luminescent screens, that are used in television receivers, radio location apparatus, oscillographs and other devices. A starterless system of lighting luminescent lamps has been developed, and is stated to be simpler than previous lighting starters as well as to lengthen considerably the service period of the luminescent apparatus.

Continuous Cellulose Cooking Discussed at Finnish Meeting

THE PROBLEM of continuous cellulose cooking, a process always eagerly sought by experts, may now be said to be solved. At the recent annual meeting of the Finnish Paper Engineers in Helsingfors, Mr. J. Richter of A. B. Kamyr, Karlstad, delivered a paper on the process. The idea leading to this development was produced by Mr. Gloersen, present managing director of the Varkaus mills, in 1938 when he was in charge of the Karhula Engineering Works. The idea was then developed by the Kamyr A. B., in which Karhula Engineering Works of Finland, the Karlstad Engineering Works of Sweden, and the Myren Engineering Works of Oslo, are interested.

Equipment has been improved in the course of ten years of experiment to the point of being in operation shape. So far it has been used only on experimental scale for sulphate at a plant connected with the Swedish

50% Longer FILTER CLOTH Life WITH THE FEinc STRING FILTER

HERE'S JUST ONE CASE

On-the-job comparisons of different types of rotary vacuum filters are rare, but when they occur FEinc usually wins out! Here's a typical report—on calcium carbonate:

Filter "A", had scraper discharge, with heavy filter cloth. Results: considerable loss of solids, high cake moisture, and low capacity. Cloth life never exceeded 30 days.

Filter "B", same size, had FEinc String Discharge, FEinc Compression Dewatering Mechanism, and used lighter, more efficient filter cloth. Here's what the user wrote:

> **"The cloth has been running over 45 days without any signs of holes wearing in it. The filtrate is clearer than that obtained with the "A" filter. Cake pick-up is better . . . Cannot understand the remarkable performance of this thin cloth."**

Reports like this may be possible in your continuous filtration—greater economy and less trouble with FEinc, the quality-built "string filter." Bulletin 101 rushed on request.

Write for details on the new FEinc pilot plant continuous rotary vacuum filter.

APPLICATIONS

Acetanalide
Alumina Hydrate
Aluminum Hydroxide
Aluminum Stearate
Barium Sulphate
Bauxite Sludge
Calcium Carbonate
Calcium Citrate
Calcium Hypochlorite
Calcium Phosphate
Calcium Stearate
Calcium Sulphate
Carbon
Cement
Clay
Cocoa Sludge
Cyanide Slimes
DDT
Disodium Phosphate
Gluten
Iron Oxide
Lactic Acid
Lime Hydrate
Lithium Carbonate
Lithium Stearate
Lithopone
Magnesium Carbonate
Magnesium Hydroxide
Maganous Acid
Nickel Carbonate
Paper and Pulp
Penicillin
Phthallic Anhydride
Rubber Reclaim
Sewage
Silica Gel
Sodium Arsenate
Sodium Carbonate
Sodium Ferrocyanide
Sodium Formate
Sodium Oxalacetate
Sodium Phosphate
Soybean Protein
Strontium Carbonate
Sugar Muds
Starch:
Corn
Potato
Rice
Wheat
Sulfa Drugs
Synthetic Rubber
Tile & Porcelain Bodies
Titanium Hydrate
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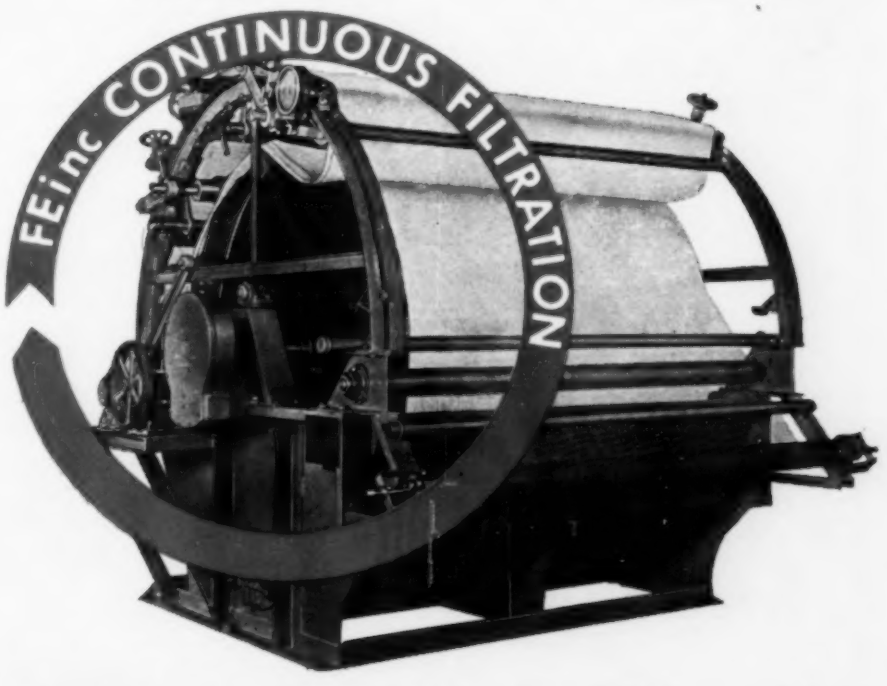
Zinc Sulphide
Vanadium Ore
White Lead



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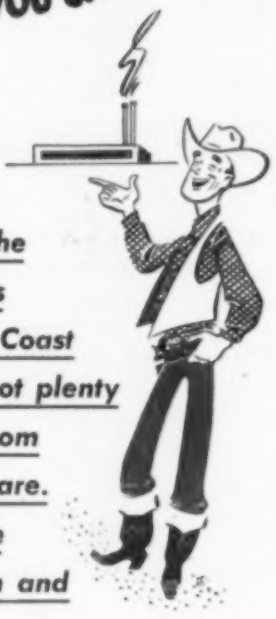
Smilin' Tex says:

"IT AIN'T BRAGGIN' IF YOU CAN PROVE IT"



On the Texas Gulf Coast we got plenty of room to spare. Come down and see.

Down here in the Texas Coast Country we got plenty of room for plenty of mill sites and homes, and plenty of what we call "elbow room" for play and recreation. This last is important to a worker and his family.

And there are other Texas "plenties": a superabundance of the chemical industry's three basic essentials — sulphur, salt and hydrocarbons.

We got plenty of natural gas — 58% of the Nation's known reserve. It's the cleanest, most economical fuel you can buy.

Plus the finest of transportation facilities—land, water and air. Friendly, intelligent "home-grown" labor; no sales tax, no state income tax.

Yes, Texas is a big state. We got plenty of room, plenty of sunshine, plenty of pure water . . . plenty of anything you need to put a new plant into the profit side of the ledger.

Send for a Survey of the Texas Coast Country. On request, we will prepare for your company a carefully engineered and confidential survey of the Texas Coast Country individualized to fit your particular problem. No cost, no obligation. Address Research Department, Houston Pipe Line Company, Houston, Texas.

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state sulphate mill at Kalix. Work on application of the method to sulphite is to be commenced at a trial plant of Messrs. Mo & Domsjö in Sweden, scheduled to begin operation this year. Four mills operating with the sulphate method are already under erection in Italy, France, and Sweden, and further mills are planned.

Purpose of the new method is to preclude necessity of emptying the digester and feeding it with fresh chips for the next cook. Emptying and filling do not interrupt cooking.

Slow Growth in Exports Worries British Chemical Industry as Shipments Fail to Meet Quotas

BOARD OF TRADE experts in Britain who are now preparing the 1949 export targets will look with mixed feelings on the chemical trade's export performance to date. Shipments abroad of chemicals and related products topped £40 million in the first half of 1948 and thus set up a new record. But more had been expected: chemical exports were to have risen from 146 percent of the 1938 volume in the second half of 1947 to 165 in the first and 173 in the second half of 1948. In fact British chemicals makers in the January-June secured only half the gain in foreign sales forecast by the authorities. In June, the best month this year, chemical exports at £7,170,000 only just reached the level of July 1947, the best month last year.

Steady as has been the export expansion so far this year, the slow rate of progress will cause heart-searchings in many quarters. It is known now that the original export targets for the chemical industry were too optimistic. Even after the revision last winter, it now turns out, they were still too high. The Board of Trade has failed to obtain from other governments that far-reaching relaxation of import restrictions that is essential to increase sales of less essential types of chemical manufactures. Vague assurances that Britain's foreign trade partners would "have regard to the normal pattern of trade in determining import licensing policy" have been found to be worth very little indeed.

True, compared with prewar days British chemical manufacturers have been able to expand their foreign business almost all along the line, with fertilizers the only really important exception. But growing domestic needs interfere with export of basic inorganic chemicals, and the reluctance of

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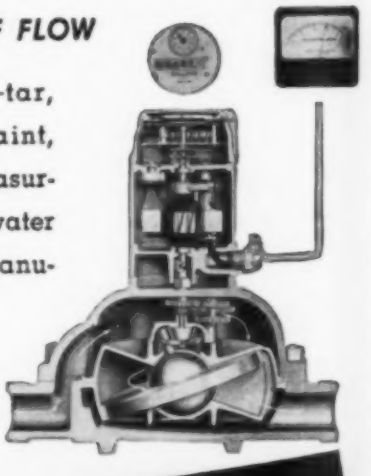
REMOTE INDICATION OF RATE OF FLOW



For practically all liquids—tar, molasses, crude oil, grease, paint, varnish, syrups, etc., etc.—for measuring, indicating, totalizing flow of water and chemicals in continuous manufacturing processes and numerous other uses. Its remote indicating feature is new—get the complete story.

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(Illustration) Simplified assembly using standard flange motors, coupling connected with high speed pinion gear shaft—making for greater accessibility.

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so many foreign countries to admit unessential products has harmed export articles in more plentiful supply. Nevertheless the over-all result would be satisfactory were it not for the country's desperate need for maximum foreign currency earnings.

Since 1938 export of dyes have nearly trebled in quantity. Those of insecticides and disinfectants have doubled. So have perfumery and toilet preparations. Paint and color exports have increased by half their prewar volume, and proprietary medicines and drugs have risen by 300 percent in value. Despite this big increase, it is the pharmaceutical section of the industry which is still a very long way from its export target, and other sections would not have done so well were it not for the development of some outstanding "specialties" which were not available at all before the war.

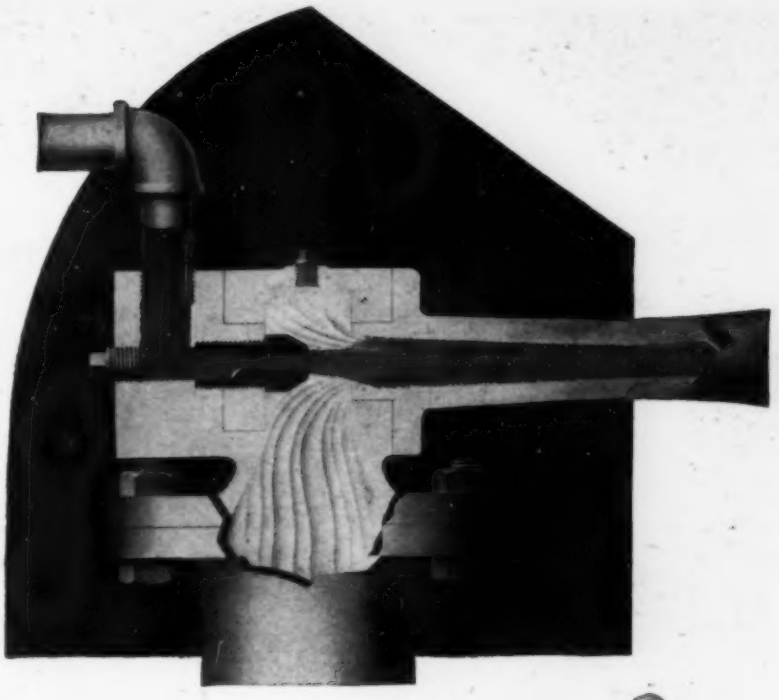
Export Targets Are High

Whether Britain's chemical exports will rise to £8,050,000 in December as the government's target plan requires will depend on the way in which the present difficulties are tackled. It is hoped that larger currency allocations for imports under license as stipulated in some recent trade agreements will widen the market for British chemical manufactures of the less essential type, less essential that is in the view of the foreign governments who have to find the necessary sterling or other currencies to pay for their imports but not necessarily from the point of view of the foreign consumer.

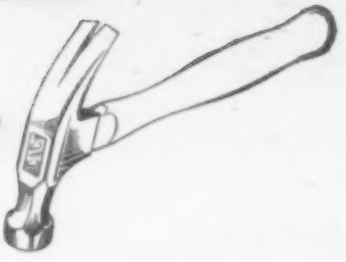
Multilateral payment and clearing arrangements with the countries of the OEEC should have the same result. Central and eastern Europe are also expected to buy more British chemicals in return for British purchases of their surplus food and raw materials. But even if foreign governments are more accommodating, British exporters are meeting some increased buyers' resistance, especially in those foreign markets which for currency reasons also attract their continental and overseas competitors. Potential consumers in these countries have been able to replenish their depleted stocks and are now once more insisting on competitive prices.

It may seem paradoxical that such buyers' resistance should be met in some quarters while in others prospective customers are only prevented by government control from increasing their orders, but such variations between one country and another and between one product and another are frequent and find their counterpart in differences in availability at home. Shipment abroad of alkalis, acids, fer-

an ƒ "reason why"



no more complicated than a hammer



A hammer is a simple, functional tool.
It has nothing to get out of order.
ƒ Jet Pumps are similar to a hammer.
They have no moving parts to get out of order.
They have no glands to adjust or replace . . .
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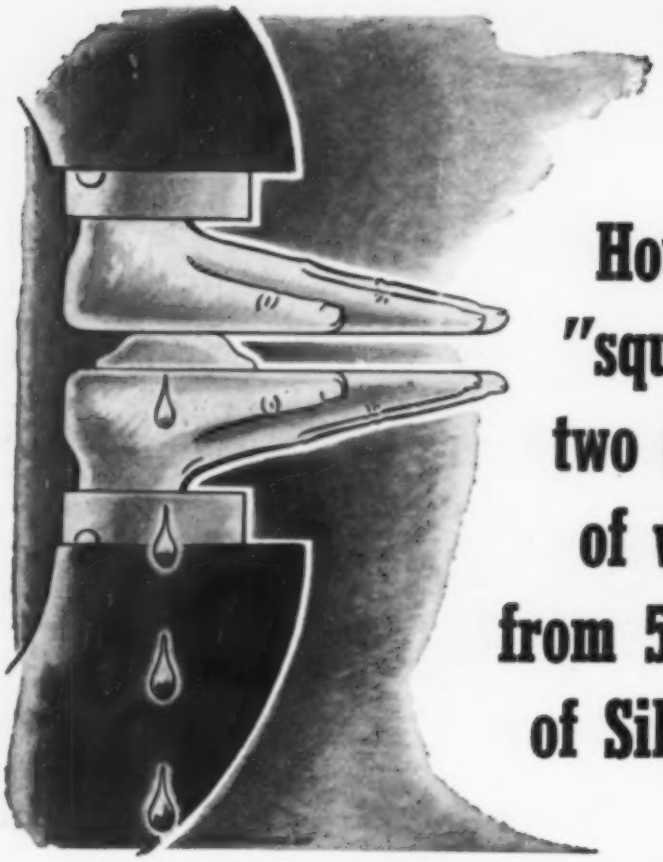

How to "squeeze" two quarts of water from 5 pounds of Silica Gel

Silica Gel, a cracking catalyst for high octane gasoline, is almost 90% water by weight!* Refiners found the dehydrating methods they were using were far too expensive and slow. So they dumped their drying problem into Hersey's lap.

Months of careful analysis and testing in the laboratory bore fruit and the first of many Hersey Silica Gel Dryers was born. Working in two stages, these dryers first bring the free water content (wet basis) from 80.3% down to 50%. In the second stage, drying is completed as the total volatile is reduced to 3%.

Result: Faster, more efficient drying, **nearly 80% cheaper than the old method** . . . greater fuel economy . . . lower initial equipment cost.

For a successful solution to your drying problem, call on Hersey. No obligation for a consultation—write or wire today.

*As it comes from the filter press.

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tilizers, coal tar products, many solvents, materials for plastics, etc., means that domestic consumers must go short even though they may need these articles for making export goods.

The British authorities agree in in principle that foreign sales of these important chemicals must not deprive the domestic consumer of essential supplies. On the other hand, it has been noted that foreign negotiators are attaching as much importance to supplies of "critical" chemicals as to other critical commodities, like coal and steel, and will offer concessions in return for larger deliveries of these chemicals. Britain is resolved to supply essential chemicals to other countries of western Europe to make ERP a success. There is consequently constant pressure on British makers of basic chemicals to export as much as can be spared without detriment to essential home consumers.

Chemical Output Pushed

Naturally great efforts are also being made to increase the production of chemicals which command a ready export market, but the opportunities for further expansion are limited. The production of soda ash, for instance, which the Board of Trade says is in as urgent demand abroad as British coal, has risen by no more than 6 percent this year. The explanation here and elsewhere is delay in the provision of new plant, and despite great efforts this bottleneck cannot apparently be widened.

No substantial additions to the British alkali output are expected before next year. Many makers of general chemicals who last year attracted attention by their ambitious expansion schemes are now explaining to their customers and stockholders why their new plants have not yet been put into commission; some fear that they will have to wait until next year or 1950. Many new projects have been put into cold storage pending concentration of all available resources on the most urgent extensions to existing plant. In the coking industry shortage of refractory materials is holding up extension and modernization; it now takes four years to complete a medium-size coke-oven plant. Distillation facilities are urgently needed in several sectors of the chemical industry, but the petroleum industry wants to buy similar apparatus from the same plant makers for its vast expansion schemes.

In these circumstances British exports of basic chemicals can hardly be expected to rise rapidly whatever the market outlook in overseas countries. Further slow progress is hoped for, and if ERP and recent trade agreements have the desired effect, the rate

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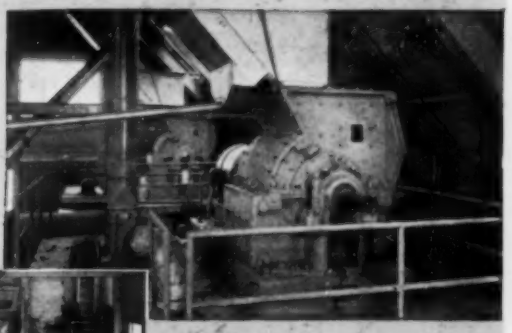

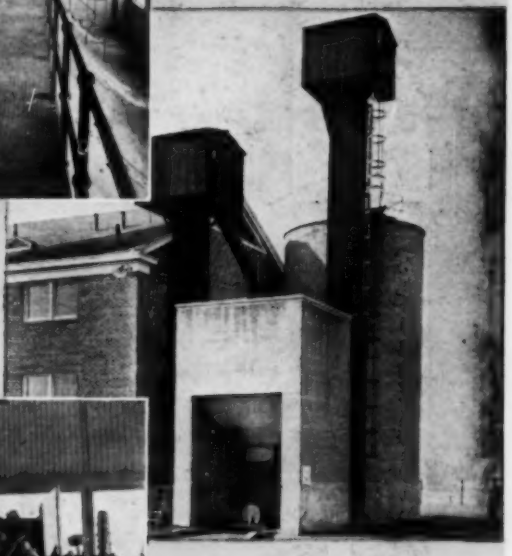

Typical installations are shown — pan conveyors, bucket elevators, feeders, pulverizers, belt and spiral conveyors.

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Facts—not phantasy—about modern materials handling methods and machines, presented in movies for consideration at *your* convenience.

How *costs*—handling costs, production costs—perennial "villains" in commerce and in industry, are meeting their master is demonstrated in seven separate "movies."

See them—in your own office, comfortably, with your own production staff; absorb the prophetic promise of profits to your business implicit in the factual film stories of how Clark fork trucks and towing tractors benefit other businesses.

Clark offers these "Movies" on a loan basis. Tell us the salient facts about your operations so that we can judge intelligently which films will be most valuable to you. Please send requests for films to the address given below.

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of advance will perhaps be a little quicker in the fall and winter. But few chemical manufacturers who have really come to grips with the export problem believe that this progress will be easy.

Liquid Fuels From Lignite To Be Made in Australia

DOLLARS will be made available to the state of Victoria to purchase American plant for the production of gas and liquid fuels from brown coal, the state's one major mineral asset.

German scientists—one of them connected with the development of the Lurgi process for gasification and liquefaction of coal—have been working quietly in the laboratories of the State Electricity Commission for several months. Their verdict is that Victoria's brown coal is suitable for gasification and as input material for synthetic gasoline plants.

The premier of Victoria and the leader of the opposition in the state legislature will personally go to Pittsburgh to inspect suitable installations.

It is not likely, however, that orders for anything but small pilot plants will be signed.

Saint-Gobain Reports on Postwar Progress

RECENT annual meeting of the Saint-Gobain chemical concern, one of France's largest, gave a good picture of the current situation in the French chemical industry. Saint-Gobain (full name is Manufactures des Glaces et Produits Chimiques Saint-Gobain, Chauny et Cirey) is not only one of the dominant French producers of basic chemicals, fertilizers, glass, and petroleum derivatives, but also has subsidiaries or financial participations in most important industrial countries.

In the U. S., the Saint-Gobain directors declared, they plan to study modernization of the Butler plant of the Franklin Corp., in order to halt the past year's decline in activity. They noted also that the Blue Ridge Glass Corp. showed increases in both sales and profits last year.

In France the year 1947 was marked by a major increase in production and sales both at home and for export. But all costs—raw materials, supplies, labor—showed a steady rise during the year, while the government-set prices were first lowered and then raised only slightly until the very end of the year. As a result the company's results from its ordinary French operations showed a loss for the year. This was made up by profits from its operations abroad.

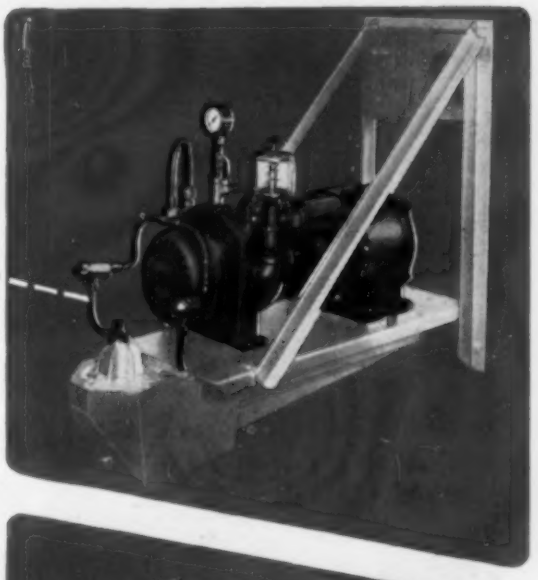
In the last part of 1947 and in Janu-

THEY MADE *AIR* DO THE WORK—

THROUGH *Visioneering* *

. . . ON A HUMIDITY CONTROL UNIT

Here's Visioneering applied by designers of a Humidity Control Unit for bakery proof-rooms. To atomize water through spray head, a Gast Rotary Compressor, as original equipment, supplies "pulseless" air pressure. No tank needed. Unit keeps air in room at 98% humidity. Direct drive, ¾ H. P. Rating is 8½ C.F.M., pressure to 25 lbs. Compressor has automatic lubricator with visible oil supply, intake filter and cooling fans.



. . . ON A FILTER FOR EDIBLE FAT

On a totally different application, air does the work on another manufacturer's Portable Filter. With pressure to 25 lbs., a Gast Rotary Compressor forces fat through filter medium. This reclaims valuable fat for re-use — effecting big savings. Gast Compressor and motor are integral — only 7" x 12" overall. Gast's packaged design also speeds manufacturer's final assembly. Rating: 1½ C.F.M. with ¼ H.P.

Both USE GAST ROTARY AIR COMPRESSORS

Notice that the two machines described are *totally unlike*, although both serve in the processing of food. Yet their designers *visioneered* them as *better* products — with Gast Rotary Compressors as original equipment.

Have *you* a design problem you can solve with AIR? Can you get improved product performance — reduced bulk — increased safety — or better control — through *visioneering*? Many designers have — by specifying Gast *Rotary Design* Compressors, Vacuum Pumps or Explosion-proof Air Motors as *original equipment*.

If *air* pressure, vacuum or power can be applied on your products, we'll be glad to co-operate with engineering help. *For details, write Gast, describing your problem.*

** Broad vision plus engineering skill.*

GAST ROTARY AIR MOTORS COMPRESSORS VACUUM PUMPS

"Air may be your answer!"

AIR COMPRESSORS — to 30 lbs.
VACUUM PUMPS — to 28 in.
AIR MOTORS — to 1 H.P.

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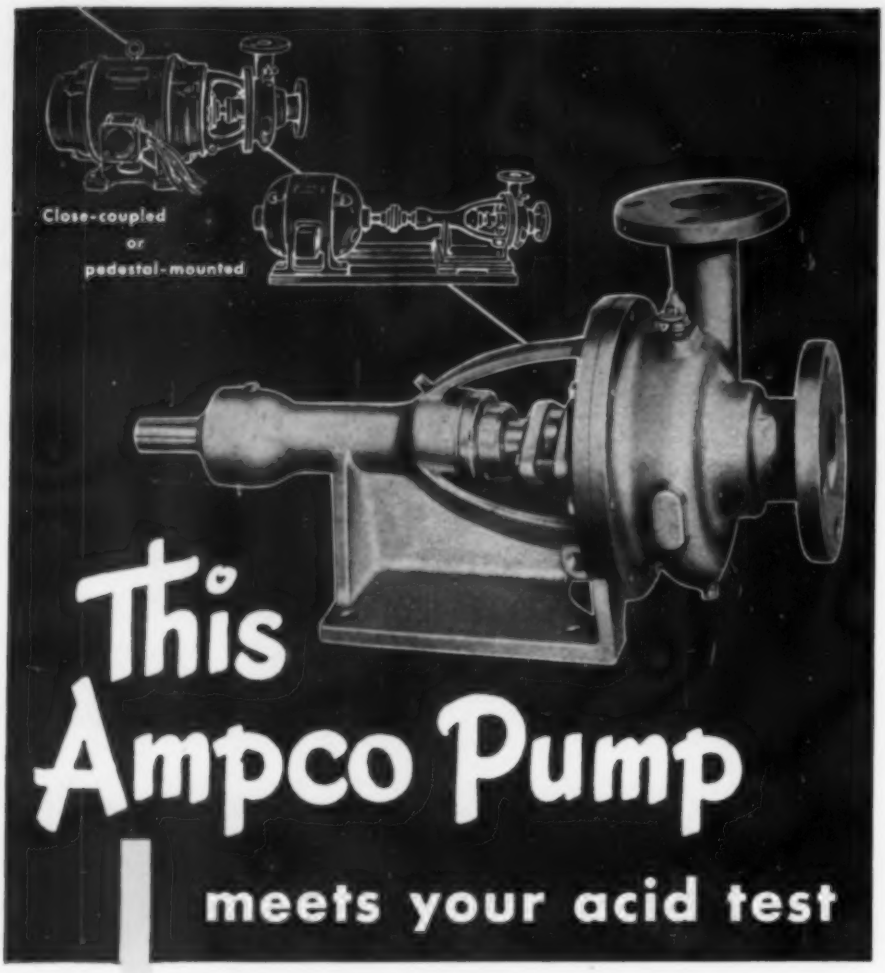


— a corrosion-resistant pump sold as a standard model without a price premium

You don't have to pay extra for special production to get a corrosion-resistant pump. Ampco's aluminum bronze centrifugal pump is a standard model — at standard-model prices.

With this new pump, you can cut the cost of original equipment, reduce replacement frequency, and be sure of efficient handling of your corrosive and erosive thin liquids. Its corrosion-resistance prevents contamination. All passages are designed for smooth, quiet flow. Grades of aluminum bronze are varied to give maximum efficiency at each point. Operation in a 500° F ambient does not change its physical properties. It is the only bronze pump that can be welded or overlaid—Ampco-Trode 10 electrode matches the base metal perfectly.

Actual performance records prove the value of this pump in breweries, and in petroleum, chemical, and food processing industries. See your nearby Ampco engineer for full details. All sizes are available either pedestal-mounted, or close-coupled to a face-type motor. Write for bulletins.

Ampco Metal, Inc.

Dept. CM-7 • Milwaukee 4, Wisconsin

ary 1948, however, most chemical prices were either freed from control or allowed to rise substantially. Despite wage increases granted at the same time, this makes the situation much more favorable. At the same time the devaluation of the franc late in January has mitigated the effect of price rises in export markets.

Sales of glass products were $17.2 million in 1947. Sales of chemical products reached $39.8 million last year. In the glass field, output was over 50 percent higher than 1946 and much higher than 1938. This was due to increased facilities, better use of equipment, and a shift from coal to fuel oil heating. Export sales were doubled despite increased restrictions and competition which forced price reductions. A good market continues throughout western Europe.

Subsidiaries Have Problems

The company's glass plant subsidiaries in Belgium, Holland, Switzerland, Spain, Italy, Germany, Poland, Czechoslovakia, Yugoslavia, Rumania, the United States and Argentina had varying fortunes during 1947.

In Belgium, output and sales increased during 1947, despite a stiffening competition which is appearing chiefly for flat and poured glass.

In Holland, shortages forced a continuation of low output at the Sas-de-Gant plant. In Switzerland the company's two subsidiaries, one producing tempered glass for autos and railroad cars and the other making fiber-glass, showed increasing activity as the Swiss economy continues full blast.

The Spanish affiliates produced at capacity last year, benefiting from new construction activity in the country and increased prices since June 1947. In Italy, activity expanded and hit capacity levels, until near the end of the year. The Pisa flat glass works was fully reconstructed and is now being extended and modernized.

The company's four German plants (Stolberg, Herzogenrath, Waldorf, and Sindorf) have now gotten into production again. Despite raw material limitations most of their former line is being turned out along with some new products.

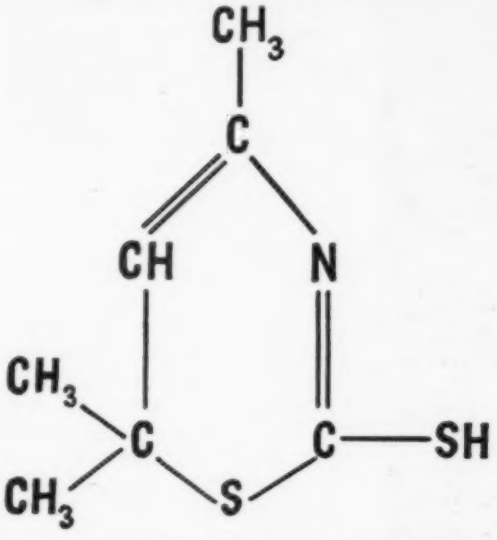
Behind the Iron Curtain, the Polish, Czech and Yugoslav plants have been nationalized, but the Rumanian unit is still operating satisfactorily.

In the United States, wartime and postwar earnings are still blocked, but the Argentine government unblocked Saint-Gobain's wartime earnings there during 1947.

On the chemical products side, despite many difficulties during 1947 including strikes, transport and materials shortages, Saint-Gobain raised its out-

3 Chemicals

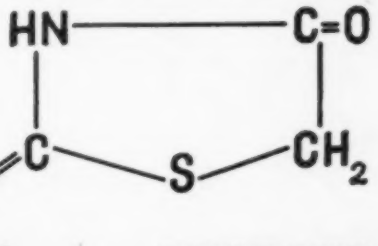
THAT MAY OPEN UP NEW FIELDS



Good-rite M.T.M.T.

2-Mercapto-4,6,6-Trimethyl Thiazine

As an intermediate, M.T.M.T. is expected to find many applications in the manufacture of wetting agents, pharmaceuticals, and other specialty chemicals not heretofore possible. As a new composition of matter, its chemical structure will suggest utility in a wide variety of fields.



Good-rite RHODANINE

2-Thio-4-Keto-Thiazolidine

This material is soluble in alcohol, ether, alkali, and hot water. Rhodanine reacts readily with aromatic aldehydes and the resulting derivatives are useful as intermediates for the manufacture of arylamino acids, arylthio-pyruvic acids, arylacetonitriles, and arylethyl amines, all with unusually high yields.

$NH_2\text{-}CH_2\text{-}CH_2\text{-}OSO_3H$

Good-rite A.E.S.A.

2-Aminoethyl Sulfuric Acid

Source of Ethylene Imine. Suggested for use in the paper industry to increase wet strength and water repellency. Recent laboratory work indicates interesting results in the treatment of cotton fibres. Since aminoethyl sulfuric acid reacts with most compounds containing an active hydrogen atom, the material is widely applicable as an aminoethylating agent.

For detailed technical bulletins on these chemicals please write Department CD-9, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio.

B. F. Goodrich Chemical Company

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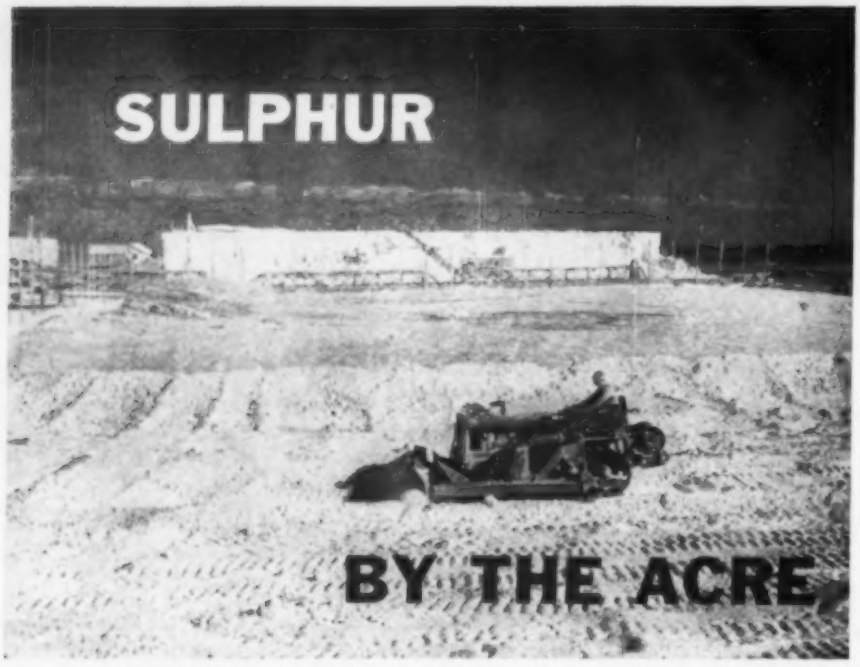
GEON polyvinyl materials • HYCAR American rubber • KRISTON thermosetting resins • GOOD-RITE chemicals



Sulphur mined from its Gulf Coast deposit will be stored in this vat of Freeport Sulphur Company at its Grande Ecaille property in Louisiana. Sulphur storage blocks of solid yellow stone often rise as high as 50 feet and stretch over as much as 5 acres.

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put to 127 percent of the 1938 level, compared with 102 percent in 1946. This is a somewhat better record than the French basic chemical industry showed as a whole.

In the sulphuric acid field seven new lead chambers and two anhydrous chambers were installed during the year, and total output was substantially above the previous year. The same holds for the salt-decomposing plants, and soda-products fabrications. Output of plastics was pushed ahead especially fast, especially monomer vinyl chloride, phthalic anhydride, and "Gobinyl," a polyvinyl resin.

In the fertilizer field, superphosphate output was substantially higher, but composed or complete fertilizers are being emphasized and sales of these were double prewar figures. Saint-Gobain is also pushing into specialty agricultural products such as insecticides, anti-parisite products and vegetable hormones.

Exports have in general been booming, but for most products the government considers that satisfaction of domestic demand must come first.

Despite this record of activity, net profits last year equalled only $1.4 million, compared with total sales for the Franco-Belgian group alone of $57 million. Because of this, some expansion plans are being curtailed, though some modernization and continued research is under way.

South African Process Industries Expanding

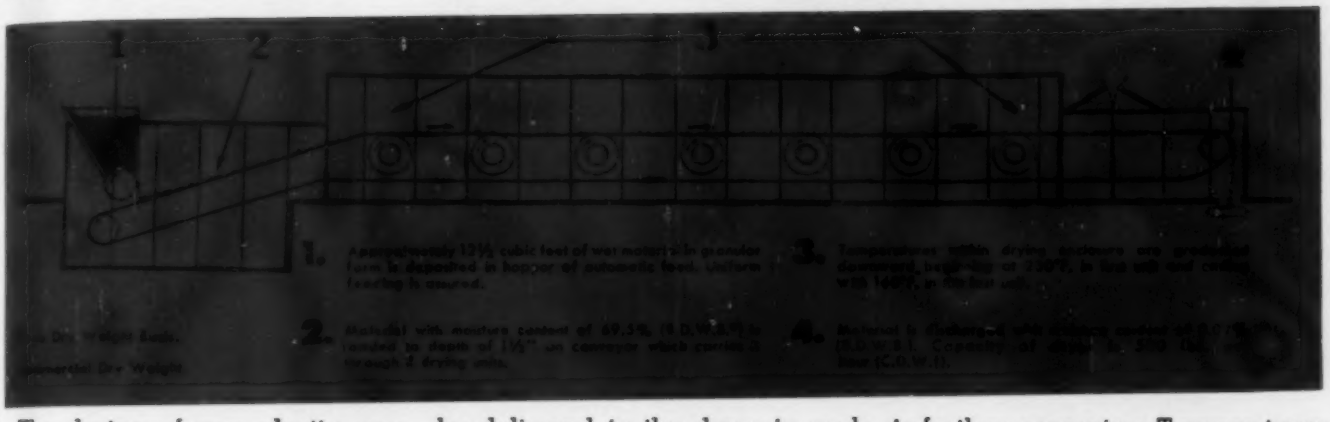
THERE IS a firm demand for 400,000 tons of Rhodesian chrome ore yearly and this market will probably remain for many years, according to the annual report of the Southern Rhodesian Natural Resources Board. It points out that it will take three and a half years to export the available stocks of chrome, without any further production, at the rate of shipment indicated by the 1947 figures. Inadequate railway and port facilities had severely restricted the production and export of base minerals from Southern Rhodesia and adjacent territories.

A cement factory which will be able to supply 12,000 bags of cement a day by the end of next year is to be built in the Cape Province at a cost of about £1,300,000. The Cape Town company behind the project is only awaiting the approval of the Minister of Mines before erecting the factory. The company, which has not yet been floated, will be known as the Olifants River Portland Cement Co., Ltd. The factory will be between Vredendal and Klaver, about 200 miles from Cape Town on the Bitterfontein railway

CHEMICAL Drying DATA 6

PUBLISHED MONTHLY FOR PROCESS INDUSTRIES EXECUTIVES AND OPERATING PERSONNEL

QUALITY CONTROLLED DRYING OF PLASTICS ACCOMPLISHED IN PROCTOR CONVEYOR SYSTEMS



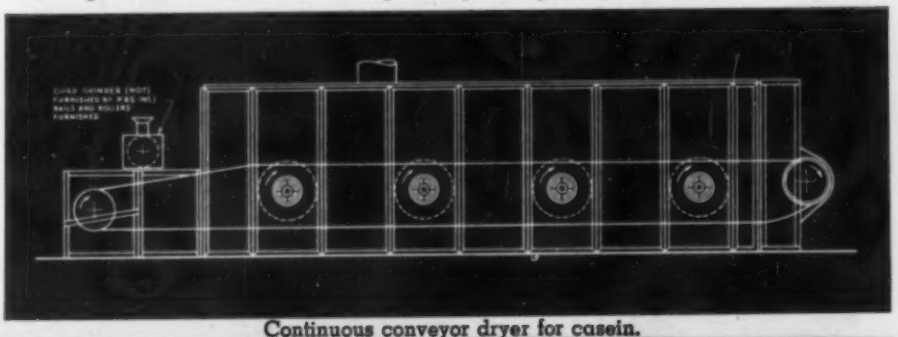
The drying of raw plastic compounds is a process that demands rigid control in order to maintain quality. When this is coupled with the industry's need for tonnage output it becomes apparent that drying can present a serious problem to the manufacturer.

CONTINUOUS OPERATION INCREASES OUTPUT

Working closely with plastics manufacturers, Proctor engineers have developed many systems that are in operation in this industry . . . meeting the demand for both close control and tonnage output. The solution to this problem has been the application of continuous conveyor drying. By studying the physical characteristics of the product and the output requirements—Proctor engineers are able to recommend a dryer designed to meet individual needs. Proctor "job-engineered" systems are in operation for drying a variety of plastics including casein, extracted soya bean proteins, peanut proteins and urea formaldehyde, to name a few. In order to take advantage of continuous drying the material must be delivered to the dryer in such form that it can be carried on a perforated metal plate or woven wire mesh conveyor . . . and in such form that heated air may be circulated *through* the entire bed of material. When this is done drying becomes rapid, thorough and uniform . . . and output is obviously kept to a high level. Automatic feeding devices are available to control the amount of material feed to the dryer at all times.

CLOSE CONTROL ASSURES FINISHED QUALITY

Plastics compounds that are subjected to too high temperatures or subjected to lower temperatures for too long a time are not well adapted to further processing. Temperatures throughout the entire system are carefully regulated and air circulation is directed in the most effective manner. Conveyor speed can be regulated. All of the factors affecting drying—temperatures, air-circulation, amount of material fed to the dryer, physical form of the material—are studied and checked against the individual plastic's requirements. The result is a drying system that meets both quality and output demands. One typical system is shown in the drawing above. If you have a plastics drying problem you may be sure Proctor engineers are in a position to recommend a system that will meet your specific needs.



Continuous conveyor dryer for casein.

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PHOTOGRAPH OF
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In Oklahoma Institutions

RESEARCH Works For INDUSTRY

Few states are more "research minded" than Oklahoma. In both state supported and privately endowed higher educational institutions an impressive program of industrial research projects is under way. Hundreds of staff members, graduate students and undergraduates engaged in this work provide a source of manpower for manufacturing plants requiring personnel with such scientific training.

Some of the principal research projects are:

Spectrographic Analysis of Oil Field Waters. ● Desirability of producing Linseed Oil From Local Flaxseed. ● Effect of Asphalt Hardness on Pavement Stability. ● Photoelectric Testing of Retro-directive Reflectors. ● Purification and Utilization of Oxidation Products of Natural Gas. ● Investigation of Storms. ● Spectrographic and Polarographic Analysis of Industrial Dust. ● Study of the Chemistry of High Temperature Reactions. ● Job Design in Petroleum Industry. ● An Investigation of Strains of Hybrid Corn For Use in the Southwest. ● Orthonormal Functions and Theory of Functions of Two Complex Variables. ● Study of Natural Resources of 13 Oklahoma Counties. ● Development of By-Products and New Products From Crude Petroleum.

A brochure of information on Oklahoma's research facilities is available to you on request.

line. Near the site there are ample supplies of limestone, gypsum, marble and takaolinitic clay. The Olifants River is only about two miles away. The plant for the factory is ready in Sweden. This factory will be welcomed by the building trade. The production of cement in the Union might be able to meet present demands, but a large increase in building is expected in the next few years.

The brand name Satrodoil has been registered for a highly fluxed road bitumen now being manufactured by South African Torbanite Mining and Refining Co., Ltd., 71 Fox St., Johannesburg. The simple application of the bitumen at a low price will result in asphalt-like black topped, non-skid roads and streets.

The chemical firm at Umbogintwini, African Explosives and Chemical Industries, has guaranteed the British government to supply East Africa as from next year, with 100,000 tons of superphosphate annually to promote the groundnut scheme in the territories. To meet the demand the firm will now have to import about 300,000 tons of raw material annually, which is more than double its present supply. The phosphate rock, which will be derived from French Morocco, will arrive in South Africa by sea at the rate of approximately 5,000 tons a week.

French Industrial Alcohol Situation Causes Headaches

FRANCE has had an industrial alcohol problem for several years. Before the war it had an overproduction of this material. While owners of the grape vineyards sought to keep their traditional market of drinking alcohol such as wines and cognacs, alcohol from grains, fruits, molasses and other sources had been giving these producers considerable competition. The state had to intervene. By the terms of the legislation that was established before the war, alcohol from vines was almost the only kind authorized for drinkable purposes. With the exception of specialties like calvados (from apple cider) and kirsch, alcohol from other sources was channeled into industrial use. Since the war the crisis of overproduction has been replaced by a deficiency of alcohol supplies. At the present time there is a tremendous need for industrial alcohol in France. The vine growers of Lanquedoc who had no manpower, fertilizer, or weed killers during the war, have not yet resumed their prewar production. Elsewhere the grape growers prefer to make drinkable alcohol which brings a bigger price than the industrial product. The cereal crop in 1947

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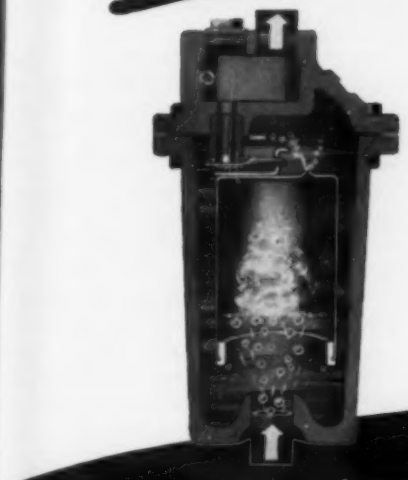

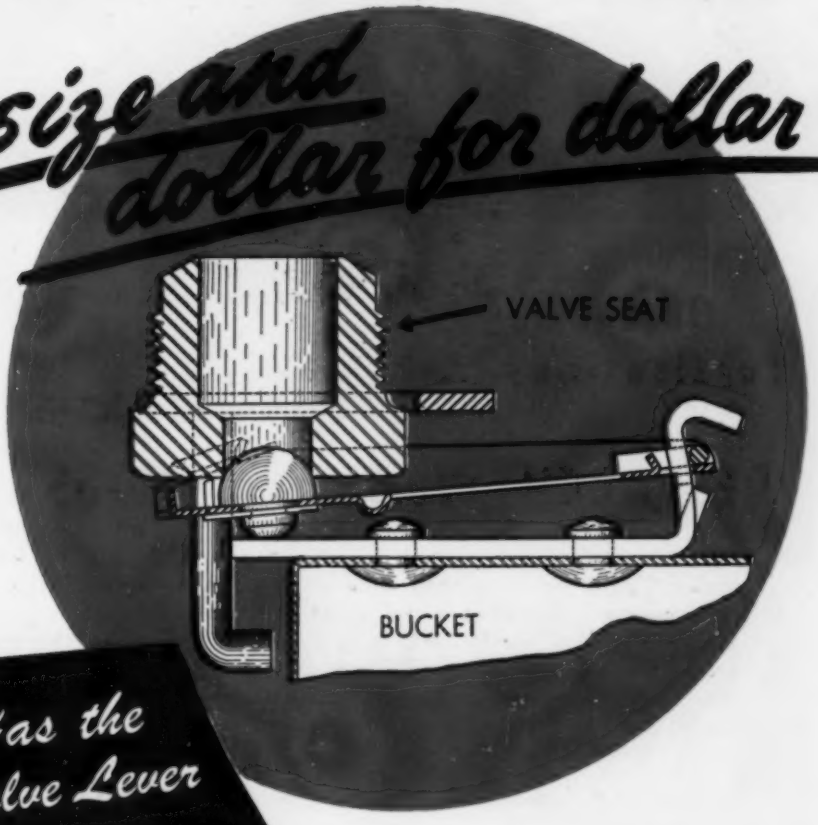

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1. High leverage that permits a small, lightweight bucket to pull open a large valve. A small bucket means a small trap and a large valve orifice is essential to big capacity!

2. Sufficient bucket travel to get the valve far enough from its seat that it does not restrict the orifice. A wide open valve means greater discharge capacity!

And, remember, Armstrong continuous discharge capacity ratings are based on actual tests with hot condensate at given steam pressures. Any trap will handle more cold water than it will hot condensate, and some trap capacities are based on cold water ratings.

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was too small to permit production of alcohol from grains. That left beet-sugar. In France sugar beets are used in two different ways—either they go to an industrial sugar refinery where sugar is extracted from the beet, and the residue such as molasses serves to make alcohol, or part of the beets are treated directly. However, some beets are bought by independent distilleries, often small and organized on a co-operative plan. The division of the beets between the refineries and the distilleries varies according to the size of the crop—since the public's sugar ration must be guaranteed. In 1947 the beet crop was mediocre—as a result, alcohol production was cut down to allow the maximum production of sugar.

Despite all these cut-backs in alcohol output the need for the industrial alcohol is constantly increasing. Use of the material as a solvent is growing rapidly and other uses are opening up.

Current Problems

At the start of the 1947-48 season the country found itself in the following situation. Production of industrial alcohol was estimated at 155,000,000 l., compared with a demand for 211,200,000 l. Beets supply 113,000,000 l., while 20,000,000 l. come from molasses. The predicted demand is made up as follows: 52,800,000 l. for drinkable alcohol (production from grapes is not actually sufficient to supply the demand in this category), 4,800,000 l. for perfume, 7,100,000 l. for vinegar, 18,400,000 for alcohol used in chemical synthesis, 10,800,000 l. for solvents, 20,000,000 l. used in the chemical industries for other purposes, 50,800,000 l. for household uses. Among the other consuming needs are 21,700,000 l. for fuels (mixtures of hydrocarbons and alcohols), 5,000,000 l. for explosives, and 12,000,000 l. for export. As a result of the shortage in supply, a cut of 12,800,000 l. has been foreseen in beverages, another 10,800,000 l. for household uses, and a slash in the neighborhood of 10,000,000 l. on certain industrial needs. Other consuming industries such as perfumes, vinegar, explosives, and fuels have also been affected to a lesser degree. Exports will also be heavily cut. This dearth of alcohol will be temporary. The beet crop has not suffered from the drought as it did last year, and potatoes will be important in supply a balance of alcohol production. Chemical industries now in full development no longer run the risk of having their ration cut off. Little by little French economy is regaining its equilibrium, according to James G. Fevrier.

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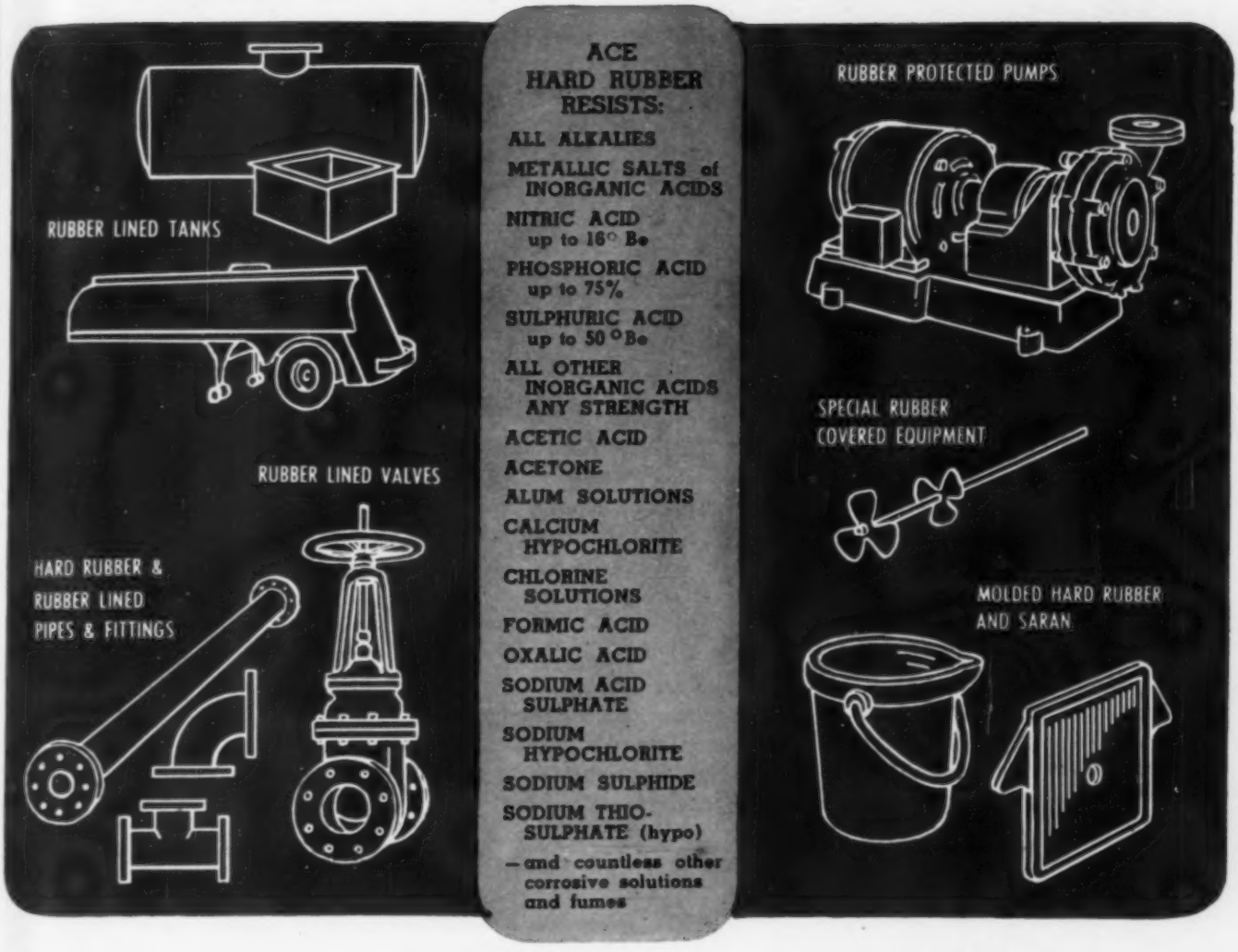
Serves - Saves - Protects

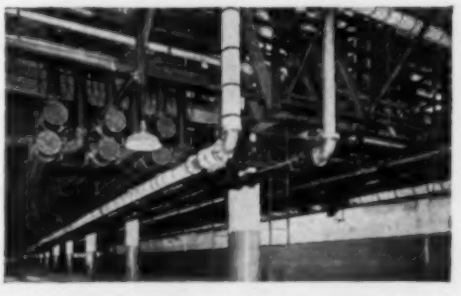


Corrosion is a constant, sly destroyer. It makes expensive equipment die young. It contaminates chemicals. It eats up operating profits.

But ACE hard rubber lining is safe—sure—economical protection against virtually every type of corrosive solution and fumes. It is available in a wide variety of standard ACE tanks, pipings, valves, fittings, and pumps... all of fine quality and workmanship, reflecting the experience gained in over 75 years of specializing in hard rubber protection.

If you need equipment for storage, processing or circulating acids, alkalies or corrosive metallic salts, it will pay you to consult ACE. American Hard Rubber Company, 11 Mercer Street, New York 13, N. Y.

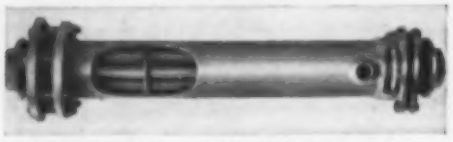
12 Miles of ACE Pipe in Rayon Plant



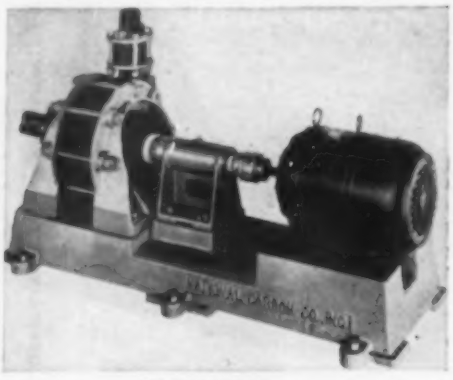
This is typical of the increasing number of ACE pipe and tank installations in rayon plants throughout the world. Other ACE products for the rayon industry include: candle filter panels, cones, caps, spinnerette couplings and goosenecks. Write for information.

ACE HARD RUBBER AND SARAN

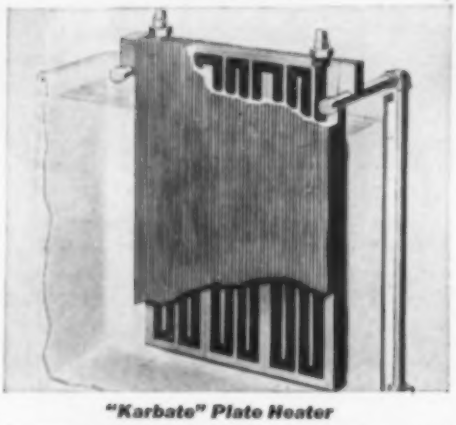
"Karbate" Sectional Cascade Cooler



"Karbate" Series 70 Heat Exchanger



"Karbate" Pump



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FOR HEATING, cooling, pumping, and conveying the corrosive solutions used in pickling and plating metal, there's no better equipment than that made of "Karbate" brand Impervious Graphite. This material is chemically inert, immune to thermal shock, easy to machine and install, light in weight yet strong; and has a very high heat-transfer rate.

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"National" carbon brick is now extensively used for lining tanks that handle corrosive solutions — particularly nitric-hydrofluoric.

For more details on metal-cleaning systems of standard "Karbate" brand Impervious Graphite units and "National" carbon brick, write to National Carbon Company, Inc., Dept. **CE.**

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Industrial Alcohol versus Construction Materials

Part I of a symposium in which a representative group of construction materials are evaluated for services involving industrial alcohol.

INTRODUCTION

WILLIAM C. MOORE
U. S. Industrial Chemicals, Inc.
Stamford, Conn.

At temperatures up to its boiling point (78.4 deg. C.) pure ethyl alcohol is probably less corrosive toward iron, steel and copper than any other common liquid. It also has little or no action on solder, tin and lead. However, in the presence of air and in aqueous solutions, if couple effects can be set up between two or more of the above metals, corrosion may occur at elevated temperatures, especially with iron, solder and lead.

Owing to the ease with which the ethylates of aluminum and magnesium may be formed, especially at elevated temperatures, ethyl alcohol may be regarded as a corrosive agent for these two metals. This action is enormously increased in the presence of mercury or its alcohol soluble salts.

Exceedingly small amounts of some impurities may enhance enormously the corrosive action of alcohol, especially toward iron and steel. A certain sample of high grade alcohol was found to have very little, if any, corrosive action toward sheet steel immersed completely therein for 51 days. On the other hand, this same alcohol contaminated with only 0.001 percent (1 part per 100,000) of sodium chloride began to corrode a similar piece of steel within twenty minutes. These tests were made at room temperature. Still another sample of alcohol had practically no action on a piece of steel partly covered by it for a period of four years.

Alcohol, originally non-corrosive, may become highly active toward metals if it becomes contaminated during a manufacturing or recovery process. This point was clearly brought out when a considerable quantity of an alcoholic solution of hydrogen chloride was distilled. In the final rectification, samples of the alcohol were taken at intervals and none of these samples responded to the silver nitrate test for chlorides. These samples were combined and used as an anti-freeze in two automobiles. The owners of both machines very soon had to purchase new radiators for their cars. Chlorides have also been found to corrode silver very rapidly in alcoholic solutions.

Because of its high solvent action on organic materials, care has to be taken in bringing alcohol into contact with organic substances, not necessarily because it will corrode or dissolve them to a dangerous extent, but mainly to avoid contamination of the alcohol by its acquiring objectionable odors or color. Certain denatured alcohols, however, may be shipped in wooden barrels which are generally "glue-lined." Another common instance of the action of alcohol on organic materials is its effect on car finishes, and in dissolving protective coatings from aluminum containers. For many years, beginning about 1919, the greatest single outlet for ethyl alcohol was as an anti-freeze for automobile radiators; and at first this protective product consisted simply of relatively pure alcohol appropriately denatured. It soon became apparent, however, that the commercial grades of completely denatured alcohol had pronounced corrosive action toward most of the metals used in automotive cooling systems, especially iron and solder. The seriousness of this situation led to a study, begun many years ago, of methods of controlling corrosion caused by coolants. This work developed along at least two lines, the use of somewhat purer alcohol and the addition thereto of specific substances to minimize or completely inhibit the corrosive action. The results so obtained have naturally been extended to include other substances used as anti-freezes, including methanol, glycerin and the glycols, with the result that today all reputable manufacturers of anti-freeze solutions are able to offer their customers a product with little or no damaging effect on automobile cooling systems. It might be added that the automotive manufacturers have aided in this work by furnishing cooling systems less liable to corrosion.

Thus, the problem of corrosion by ethyl alcohol almost becomes the problem of corrison by denaturants. These at present are approximately 100 in number, and they include such diverse substances as iodine, sulphuric acid, brucine, several ketones, several aldehydes, various esters, acetic acid, many essential oils, benzene, and complex mixtures such as those obtained by the destructive oxidation of certain petroleum fractions, or from certain cuts of liquids obtained by the destructive distillation of wood. The end use of alcohol determines which formula is available to the purchaser, and thus the corrosion problems incurred by users of alcohol are based very largely on the formula or formulas involved, superimposed upon the normally insignificant corrosive properties of alcohol itself. The apparatus difficulties of an ester manufacturer using alcohol denatured with sulphuric acid are quite different from those of a pharmaceutical concern which employs alcohol denatured with acetone.

Then there is the further complication introduced by impurities. At present the major processes for obtaining industrial ethyl alcohol are the fermentation of sugars and the cataly-

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When other methods are unsatisfactory, acid solutions in tanks of any material can safely be heated by Vitreosil electric immersion heaters.

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THE HILLIARD CORPORATION
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tic hydration of ethylene. Raw alcohol manufactured by either of these methods is decidedly impure. The impurities in raw synthetic alcohol may consist of acids (including sulphuric and sulphurous), other alcohols, ethers, esters, aldehydes and possibly hydrocarbons. The impurities in fermentation alcohol may consist of more or less volatile compounds of the following classes: sulphur derivatives (sulphides and mercaptans), ethers, esters, aldehydes (like acrolein, acetaldehyde and crotonaldehyde), other alcohols and organic nitrogen derivatives.

Since regulations concerning the use of alcohol are so strict, users of this chemical are required to reveal to the government and to their source of supply the general features of the processes wherein the alcohol is to be used; thus it happens that the manufacturer of the alcohol is always in a position to give each customer personal advice as to any corrosion problems involved with each permissible formula for the project in hand.

CHEMICAL STONEWARE

F. E. HERSTEIN
General Ceramics and Steatite Corp.
Keasbey, New Jersey

CHEMICAL stoneware is impervious to ethyl alcohol at all concentrations and temperatures. The only temperature limitations are those to which chemical stoneware is normally subjected. However, due to the fact that other materials of construction which are more economical and offer other advantages such as weight and ease of fabrication are also impervious to ethyl alcohol, chemical stoneware is not widely used for the handling of this material. During the war, due to scarcities of metals, chemical stoneware was sometimes used for tower sections and piping, but as these other materials became available, the use of stoneware has declined.

CONSTRUCTION MATERIALS FOR JET PUMPS

(Continued from page 117)

Vacuum pumps have already been discussed.

Low pressure blowers use either steam or gas jets to move large volumes of air, gas or vapor at low draft. They may, for example, transfer a mixture of oil vapor and air from a boiling kettle to the boiler furnace. There is normally no corrosion problem but may be a high-temperature or weight problem; cast iron, high-temperature steels or aluminum are

IF you PUMP, PIPE or HEAT corrosive chemicals this EQUIPMENT belongs on your flowsheet

CORROSION-RESISTANT CONSTRUCTION

Durco equipment gives you: The proper alloy . . . the proper design . . . no coating or linings . . . corrosion resistance as thick as the metal itself.

MADE IN SPECIALIZED ALLOYS FOR SPECIFIC SERVICES

DURIRON—a high-silicon iron (14.5% Si.). For most commercial corrosives—particularly sulfuric, nitric and acetic acids at any strength or temperature. Bulletin 11.

DURICHLOR—a high-silicon molybdenum iron. For greater resistance to hydrochloric acid and its compounds, especially at higher temperatures and concentrations. Bulletin 50.

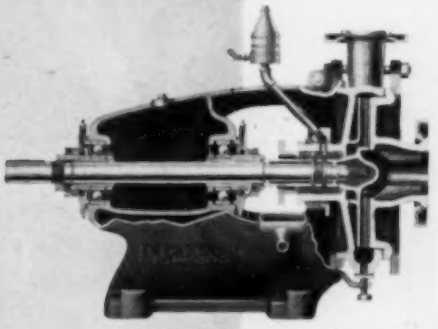
DURIMET 20—a high Ni-Cr-Mo-Cu low carbon stainless steel. For sulfuric and sulfurous acids, oleum, caustic, and other solutions. Bulletin 112.

CHLORIMET NO. 2 — nickel-molybdenum alloy; **CHLORIMET NO. 3**—nickel-molybdenum-chromium alloy. Chlorimet No. 2 for HCl in all concentrations and temperatures. Excellent for hot H_2SO_4 under reducing conditions and wet hydrogen chloride gas. Chlorimet No. 3 for most acids under oxidizing conditions, various salt solutions, hot sulfuric in concentrations of less than 35%. Bulletin 114.

OTHER ALLOYS — Durco D-10, Monel, Inconel, Pure Nickel, Ni-Resist and Nickel Cast-iron.

WHICH ALLOYS TO USE—*Write for Bulletin 100. It lists 155 corrosives and tells which Durco alloys handle each. For information on specific alloys and equipment, write for the bulletins mentioned above.*

Durco Adv. 69-GM



Model 40 Durcopumps. Capacities up to 2,000 GPM; heads as high as 230 feet. Bulletin 815.

Durco Valves are made in a variety of popular types including Y and Angle Valves, Bul. 615, Plug Valves (Lubricated and Non-Lubricated) Bul. 617, 618 and 635, Diaphragm Valves, Bul. 623A.

Durco Split Flanged Pipe — Made in Duriron and Durichlor only. Standard sizes 1½" to 8", Bulletin 704.

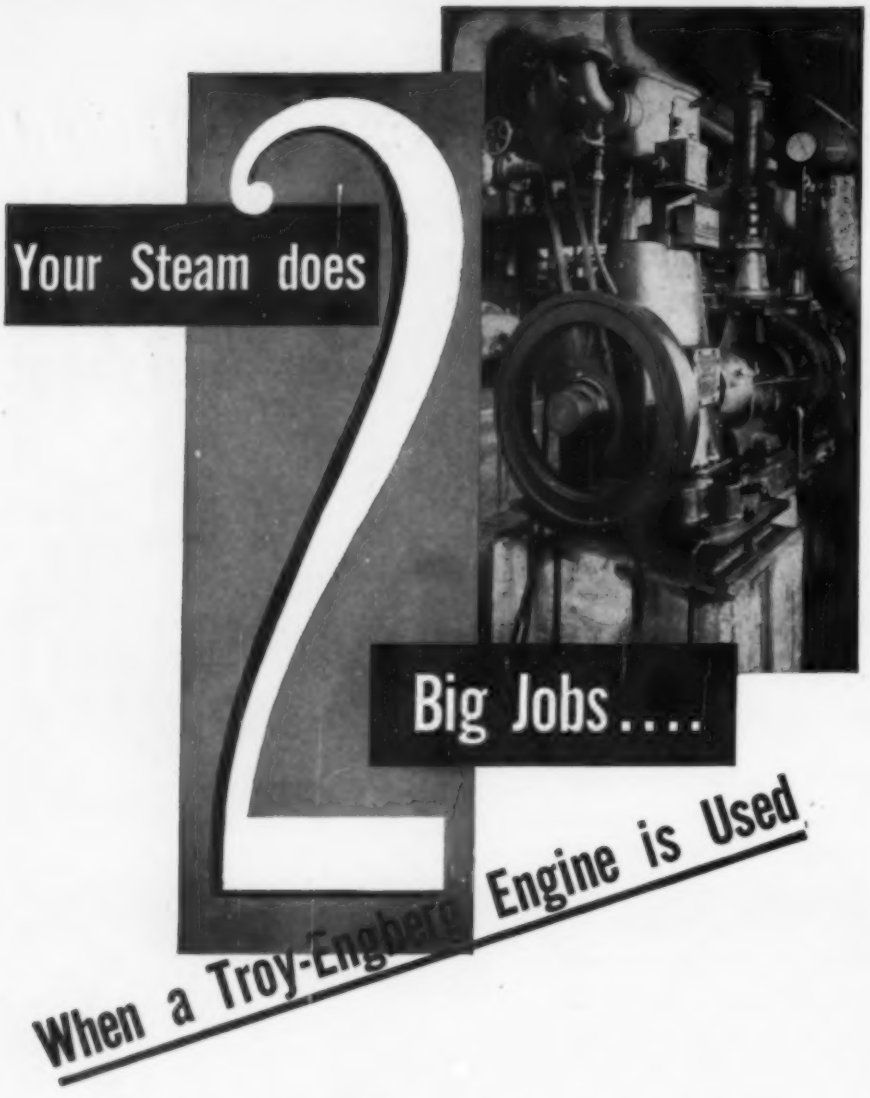
Durco Heat Exchangers—Made of Duriron only. Can be set up in series or parallel to handle from 5 GPM to 100 GPM with temperature changes of 300°. Bulletin 1610A and 1611.

DURCO
CORROSION RESISTING ALLOYS & EQUIPMENT

THE DURIRON CO., INC.

DAYTON 1, OHIO

Branch Offices in Principal Cities



With proper plant heat balance your steam may do two big jobs. If you generate steam for processing or heating a Troy-Engberg Steam Engine can produce By-Product Power at a very low cost. The same steam then yields power as well as heat units!

It's the simplest story in the plant. Steam is first passed through the engine—driving cookers, driers, cutters, pumps, blowers, compressors or generators. Then the exhaust, with most of the original heat units still intact, is used for processing or heating. And for dependability nothing beats the standard counterflow steam engine . . . no interruptions from power failure.

TROY ENGINE & MACHINE COMPANY

(Established 1870)

1300 Railroad Avenue **Troy, Pennsylvania**

TROY-ENGBERG

STEAM ENGINES • GENERATING SETS • GENERATORS

therefore employed as materials of construction.

Jet compressors use high pressure gas or steam to entrain low pressure gas or steam and deliver it at an intermediate pressure. For example, exhaust steam can be compressed for heating an evaporator or kettle. Steam-jet and gas-jet compressors are subject to the same corrosion and erosion problems as vacuum pumps.

Liquid to Move Gases—Pumps in this category are employed as absorbers or scrubbers, vacuum pumps and multi-jet condensers.

Jet absorbers or scrubbers are water jet aspirators used to entrain gases from a cooking or chemical process, condense steam, scrub and knock down dust, and remove irritating odors. Corrosion problems are severe and are combined with problems of unusual size since the intake diameters may vary from 3 in. to 72 in. All metals can be fabricated to the full 72 in. diameter. Of the nonmetals, graphite can go to 28 in., Haveg to 12 in. unsupported, and stoneware to 8 in. unsupported; hard rubber can be used for nozzles only, although rubber linings are possible in diffusers of any size.

Vacuum pumps using water jets are applied for exhausting and compressing where steam is lacking and pressure water is available. Temperature limits of construction materials are not a factor in these pumps, but corrosion, close tolerance, and the erosive effect of high water velocities (150-200 fps.) must be met.

Multi-jet condensers use the kinetic energy of multiple, converging water jets to produce vacuum, to condense steam, or to remove noncondensable gases. They are employed in vacuum cooking, in cooling and drying, crystallizing, deodorizing, oil refining and on the exhaust from steam engines and turbines. Corrosion and erosion are the main problems. In many cases metals are used for the main parts with graphite throat bushings to reduce corrosion where the jets fall after converging.

Steam to Move Liquids—Pumps in this category are employed as boiler injectors, syphons and heaters.

Boiler injectors are used to feed water against boiler pressure, at the same time lifting and heating it; they are also used to heat water under high pressure for washing processes. The problems are only those of strength and erosion (pressures go up to 450 psi.). Monel, bronze or stainless steel meet these requirements.

Steam-jet syphons are used to pump liquids, particularly where heating is also desired or where corrosive or abrasive liquids would cause difficulty

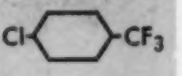
Hooker Chlorobenzenes Available for Prompt Shipment

Hooker manufactures five chlorobenzenes, principal of which are monochlorobenzene and paradichlorobenzene. These products are of exceptionally high quality to insure the best performance in your applications.

If you are not yet familiar with Hooker quality and service, we invite you to test these materials. Literature and samples are available when requested on your business letterhead.

HOOKER RESEARCH Presents

p-CHLOROBENZOTRIFLUORIDE
(p-chlorotrifluoromethylbenzene)



Molecular Weight	180.56
Freezing Point	−36° C
Boiling Point	139.3° C
Specific Gravity, 15.5°/15.5° C	1.353
Refractive Index, n20/D	1.446

The physical and chemical properties of p-chlorobenzotrifluoride indicate the possibility of many applications as a dye intermediate, chemical intermediate, solvent, and dielectric fluid.

This new Hooker product is a clear, water white, aromatic liquid. It is characterized by the trifluoromethyl group which is generally stable to heat, light and to chemical reaction.

Hooker p-chlorobenzotrifluoride is available in experimental quantities. Technical Data Sheet No. 362 describes more completely its physical and chemical properties. Please use your company letterhead when requesting sample or literature.

PARADICHLOROBENZENE
(1, 4-dichlorobenzene)

$C_6H_4Cl_2$

DESCRIPTION:
White to clear, transparent crystals with a pleasant aromatic odor. Soluble in most organic solvents; insoluble in water. Available in seven regular sizes.

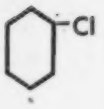
PHYSICAL DATA:

Mol. Wt.	147
M. P.	53° C
B. P.	173° C
Flash Point	73° C
Fire Point	108° C

USES:
Recommended and widely accepted as a highly effective insecticide for agricultural and domestic purposes in control of: peach tree borer, black peach aphids, tobacco blue mold, clothes moths, carpet beetles, fish moths, garden centipedes, etc. Also used in the manufacture of sanitary specialties such as deodorants. As a chemical intermediate in organic synthesis, it is used in the preparation of a variety of chemicals, especially dyestuffs.

MONOCHLOROBENZENE
(phenyl chloride)

C_6H_5Cl



DESCRIPTION:
Clear, colorless, moderately volatile liquid, with a characteristic mild odor. Completely miscible with most organic solvents; immiscible with water.

PHYSICAL DATA:

Mol. Wt.	112.5
F. P.	−44° C
B. R.	131.3° to 132.3° C
Sp. Gr., 15.5°/15.5° C	1.113 ± .001
R. I., n20/D	1.524
Flash Point	29° C

USES:
Intermediate in manufacture of insecticides, dyestuffs, drugs, perfumes, and other organic chemicals; solvent for paints, varnishes, lacquers; general organic solvent; heat transfer medium for condensing vapor systems.

Technical Data Sheets on the other Hooker Chlorobenzenes: orthodichlorobenzene, trichlorobenzene, hexachlorobenzene, are also available upon request.

From the Salt of the Earth

HOOKER ELECTROCHEMICAL COMPANY

HOOKER CHEMICALS

5 FORTY-SEVENTH ST., NIAGARA FALLS, N. Y.
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CAUSTIC SODA • PARADICHLOROBENZENE • MURIATIC ACID • CHLORINE • SODIUM SULFIDE • SODIUM SULFHYDRATE

TURBO JOINTS

for EXTRA MOVEMENT at EXCESSIVE PRESSURES and EXTREME TEMPERATURES

Concentrate large expansion requirements in this *one* packless joint that *cannot* squirm or buckle.

MagniLastic Turbo Joints feature an entirely different principle in expansion joint design. Pressure is applied *externally* to a very elastic atomically-welded stainless steel bellows. This allows extra-long travel without danger of squirm or need for external reinforcement or guiding.

For the first time practically unlimited expansion and contraction in a piping system can be concentrated in a single expansion joint.

Where long piping and limited space for anchorage is encountered, Turbo Joints save on installation, eliminate anchoring of nearby points, and are maintenance free for the life of the system.

Turbo Joints are made in all pipe sizes up to 24 inches, for all pressures up to 1500 psi., and for temperatures to 1600°F.

Write for catalog T-1

MAGNILASTIC

Division of COOK ELECTRIC COMPANY, Chicago 14

"THERE IS A MAGNILASTIC EXPANSION JOINT FOR EVERY PIPING NEED"

with mechanical pumps. Problems are the same as those for high vacuum pumps and the same factors guide selection of materials of construction.

Heaters are similar to syphons except that the main purpose is heating; pumping is secondary. The manufacturing problem is to maintain thin wall sections and close tolerances against active corrosion. Metals therefore are most suitable.

Liquid to Move Liquids—Pumps in this category are classified as eductors. The pressure liquid, usually water, discharges at high velocity through a converging nozzle and entrains the suction liquid. Eductors are as valuable for their mixing action as their pumping. They are used, for example, to add chemicals to water systems for purification, boiler feed treatment, neutralization, or whatever. All the corrosion and erosion problems found in high vacuum pumps are present with the exception of high temperatures. Materials of construction are the same, although the temperature factor can be eliminated in their selection.

Steam to Move Solids—Steam-jets in this category are called syphons or exhausters. They are similar to the steam-jet vacuum pump but are designed to handle dust-laden air or solids-laden liquids, and have a large open throat to accommodate slurries without clogging. For example, they are used to move viscous residues from storage tanks and, with a long hose connected to the suction, can be used for cleaning. Steam ejectors for solids have all the problems of high vacuum pumps plus the erosive action of solid particles traveling up to 1,500 fps.

Liquid to Move Solids—Water-jet eductors are designed to handle granular solids or slurries. They are used to mix powders into a liquid, to handle sand in flotation processes, to convey dirty sand from filter beds, and to introduce materials such as carbon black, diatomaceuos earth and powdered limestone into piplines. All previous problems of corrosion and erosion are encountered, with water-jet velocities up to 150 fps.

Acknowledgment is gratefully made to E. G. Ross of Worthington Pump and Machinery Corp.; H. Bradshaw, C. Sweet and J. Plummer of Ingersoll-Rand Co.; J. H. Peterson of Schutte and Koerting Co.; and J. H. Kratz of C. H. Wheeler Co. for their assistance in preparing the section on high-vacuum pumps; to G. Blatchley of Schutte and Koerting Co. for assistance with the section on ejectors; to P. Freneau of the Elliott Co. and to the National Carbon Co. for assistance with the table of chemical resistances and for engineering data.

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CHASE NATION-WIDE BAG SERVICE

ONE HUNDRED YEARS is a mighty long time. It also can be a rather uneventful span . . . nothing of much importance is recorded between 847 and 947 A.D. It can also be a century of great events and progress—1847-1947, for example. And this is the period of our experience in manufacturing bags of all kinds for American industry and agriculture.

This experience is a very important part of the background that your technically trained Chase Salesman brings to bear on your packing problems. Whatever your packing needs may be, Chase can provide an efficient and economical container for your products. It will pay you to check with your nearby Chase Salesman.

Chase factories and sales offices are strategically located to quickly serve your specific requirements.

Chase Multiwall Paper Bags | Chase Topmill Burlap Bags | Chase LB Ipack Paper Bags | Chase Sax-o-in Open Mesh Bags | Chase Lined and Combined Bags | Chase Specialties: Mailing Bags, Spiral Tubing, Twines | Chase Pretty Print Cotton Bags | Chase Heavy Duty Cotton Bags | Chase Liners—Crinkled and Pleated

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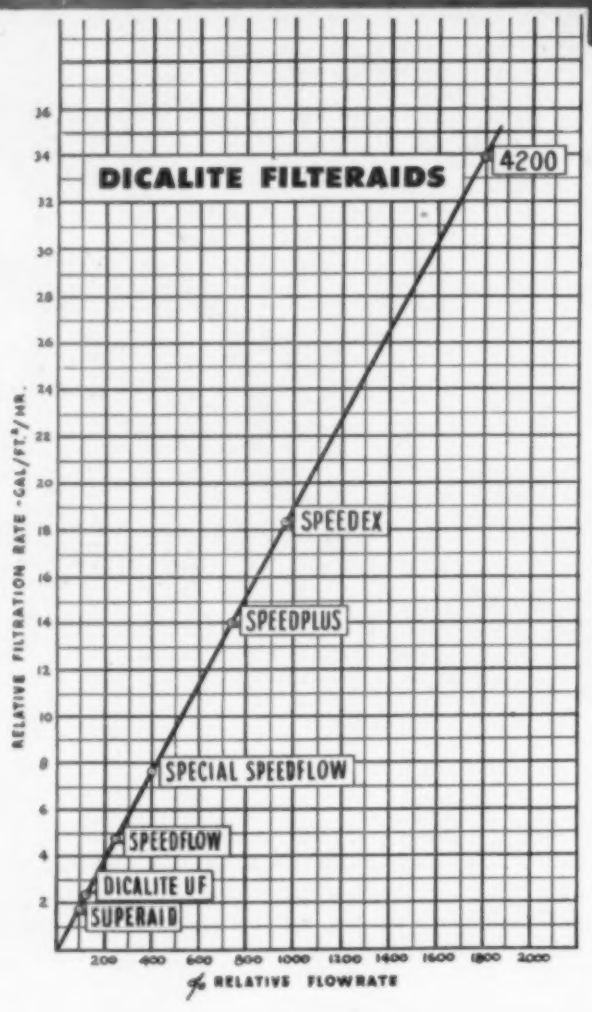
DICALITE FILTERAIDS . . .
how used in filtering all types of liquors for maximum flexibility and economy



● Flexibility of operation is a key to maximum economy and quality of output in filtration. The chart shows the relative "speed" of the different grades of Dicalite filteraids, and indicates how this flexibility can be secured.

While each one of these grades is especially effective for filtering certain liquids, their performance overlaps considerably and you may secure desired clarity with different grades selected according to your operating needs. Sudden production demands for higher liquid throughput can be satisfied by using the grade having the filtration rate next higher than that normally used. If a hard-to-filter batch of liquor slows down the flow too much, the next faster grade of Dicalite will usually maintain your normal filtration flow rate.

Such flexibility of operation will hold filtration costs to a minimum, and will reduce overall operating costs by eliminating expensive slow-downs. High quality of finished product is also maintained.

You can depend on Dicalite filteraids because they are quality materials, produced to high standards of performance with constant laboratory control. Send for a Dicalite Engineer if you need information on filteraids, or if he can help you with a filtration problem. The facilities of the Dicalite laboratory are also available if extensive tests are required.

BULLETIN B-11

Write for a copy of this booklet which gives much useful information on using diatomaceous filteraids. No charge or obligation.

THE DICALITE COMPANY
DIVISION OF GREAT LAKES CARBON CORPORATION
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DICALITE FILTERAIDS

NAMES IN THE NEWS

Man of the Month

D. A. MacInnes

The Edward Goodrich Acheson Medal and Prize has been awarded to Dr. Duncan A. MacInnes, a member of the Rockefeller Institute for Medical Research and former president of the Electrochemical Society. The award is for outstanding contributions to the field of general and theoretical electrochemistry.

Presentation of the prize and medal is to take place at a banquet which will be held at the Hotel Pennsylvania October 14. This will be one of the principal events of the Society's New York convention.

Dr. MacInnes, a native of Utah and a graduate of its State University, has been with the Rockefeller Institute since 1926. Previously he taught at the University of Illinois and Massachusetts Institute of Technology.

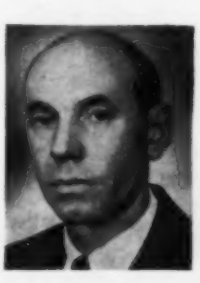
In addition to his membership in the Electrochemical Society, he is a member of the National Academy of Sciences, American Chemical Society, American Academy of Arts and Sciences and the Harvey Society. Dr. MacInnes was awarded the William H. Nichols Medal in 1942; he was Priestley lecturer in 1943; and Sigma Xi lecturer in 1940. He is the author of many papers in the field of electrochemistry as well as the well-known text "Principles of Electrochemistry."

Leo W. Briggs, assistant director of research of the American Potash & Chemical Corp., Trona, Calif., has been elected chairman of the Mohave Desert section of the American Chemical Society. He succeeds **Ross W. Moshier** of the Naval Ordnance Test Station, China Lake, Calif.

Charles H. Prien has joined the Agricultural Industries Service staff of the Board of Trustees for Rehabilitation Affairs, Shanghai, China, as resident research engineer in chemical engineering. Dr. Prien has for the past seven years been assistant professor of chemical engineering at the University of Colorado.

Gordon A. Boelter has been elected vice president in charge of production for Standard Perlite Corp., Los Angeles.

Edward S. Harlow, coordinator of research in the American Tobacco Co. laboratory, Richmond, Va., has been elected chairman of the Virginia section of the American Chemical Society. He succeeds **Clifford M. Smith** of E. I. du Pont de Nemours & Co., Waynesboro.



H. F. Miller

H. B. Warner

H. F. Miller has been named production manager of plants for B. F. Goodrich Chemical Co. **H. B. Warner** is now plant manager of Avon Lake experimental station. **F. C. Hands** has replaced Miller as plant manager of Plant 3 in Akron.

James B. Irwin, Jr., has been appointed assistant to the president of Monsanto Chemical Co. Irwin is at present supervisor of the chlorine department at the company's Monsanto, Ill., plant. He succeeds **R. U. Haslanger,** who has been named assistant to the general manager of the western division, at Seattle, Wash.

C. G. Kirkbride, director of laboratories for Houdry Process Corp., has been elected vice president in charge of research and development.

C. G. Kirkbride

P. Queneau

Paul Queneau has been appointed metallurgical engineer of the International Nickel Co. of Canada, Ltd., and subsidiaries. Mr. Queneau has been superintendent of research at International Nickel's mines and plants in Ontario. His headquarters are now in New York.

W. C. Bryant has been promoted to the position of chief research chemist at Swan-Finch Oil Corp.

Thomas R. Linak, area technical supervisor of the B. F. Goodrich Chemical Co., Louisville, has been elected chairman of the Louisville section of the American Chemical Society, succeeding **Wilson R. Barnes.**

John D. Hatfield of the division of chemical engineering of the Tennessee Valley Authority, Wilson Dam, Ala., has succeeded **H. Leroy Thompson** as chairman of the Wilson Dam section of the American Chemical Society.

Robert M. Lowell is now development chemist in charge of development department at Edwal Laboratories, Inc., Chicago.

Charles W. Selheimer, head of personnel selection and training in the development department of the United States Rubber Co., has been

named professor of chemical engineering at Illinois Institute of Technology. From 1936 to 1946, he was assistant and associate professor of chemical engineering at Wayne University, Detroit. He joined U. S. Rubber two years ago.

Stanley R. Wilson has been appointed secretary of Universal Oil Products Co.

Lyle I. Gilbertson has been appointed coordinator of government research in Air Reduction Sales Co.'s research and engineering department.

John H. Jordan, assistant manager of the agricultural chemicals section of the Grasselli chemicals department of Du Pont, has retired after more than 43 years with the company.

Charles H. Starling has been named southeast district engineer of Infilco Inc. with headquarters in Decatur, Ga. He replaced **Fred A. Eidsness** who became Philadelphia district engineer.

John J. McKetta, Jr., associate professor of chemical engineering at the University of Texas, has been elected chairman of the Central Texas section of the American Chemical Society. He succeeds **Robbin C. Anderson,** head of the department of chemistry at the university.

Arthur E. Heming, formerly of Johnson & Johnson de Argentina and Johnson & Johnson de Brazil, has joined Smith, Kline & French Laboratories, Philadelphia, as a research biochemist.

N. Howell Furman, proressor of chemistry in Princeton University, received the newly established $1,000 Fisher Award in Analytical Chemistry at the Midwest meeting of the American Chemical Society in St. Louis September 6.

Richard R. Fryer has been appointed head of the small lots department of Edwal Laboratories, Inc.

Harry B. Hill, petroleum engineer of the Bureau of Mines and supervisor of the Dallas, Tex., field office for the last 24 years, has retired.

F. C. Peterson has recently been promoted to the position of production manager of the cellulose products division of the Dow Chemical Co., Midland, Mich.

Robert P. Logan, for the last three years assistant professor and research specialist of the department of sanita-

Rugged Quality
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--MORE YEARS OF SERVICE

There is more genuine old fashioned quality in Layne Well Water Systems than today's buyer has a right to expect. We've been building them for over sixty-five years and know that every little gadget must be tough enough to last. But right along with quality we have constantly improved efficiency—stepping it higher and higher.

Just put those two factors together—quality and efficiency and demand them in your Well Water System, and you'll end up by owning a Layne.

It isn't as if we had built only a few Layne Well Water Systems that happened to turn out pretty good. For many years we have been building them for a world wide trade: Europe, India, Africa, Indo China, Mexico, Venezuela, South American Countries, Canada and hundreds for the United States.

A lot of cities, railroads and industries of all kinds use Layne Well Water Systems exclusively and will consider no other kind. They seem to know that they are getting a mighty big dollar's worth of real value.

For further information, catalogs, bulletins, etc., address Layne & Bowler, Inc., General Offices, Memphis 8, Tenn.

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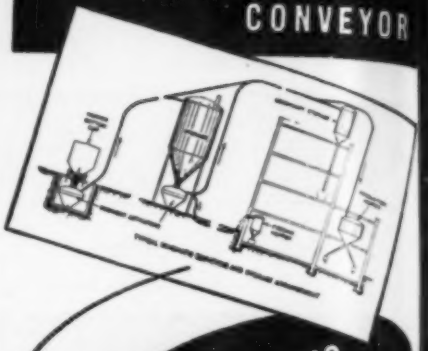
ROBINSON
Air-Activated
CONVEYOR



THE PNEUMATIC CONVEYOR
THAT'S DIFFERENT
. . . AND MORE ECONOMICAL

This conveyor is designed to handle DRY-PULVERIZED or FINE-GRANULAR Minerals and Food Products. It is designed to operate with low-volume air and to remove most of the moisture from the air to prevent encrustations in the conveyor pipes. It is designed to operate without continuously moving parts such as screw feed, bearings and other parts which cause high maintenance and require frequent replacement.

The Robinson System uses closed, dustproof equipment, and is showing great economies in handling many kinds of products. It is the product of experienced Materials-Handling Engineers who will be glad to discuss your materials-handling problems when they involve dry-pulverized or granular materials.

Division of MORSE BOULGER DESTRUCTOR CO.

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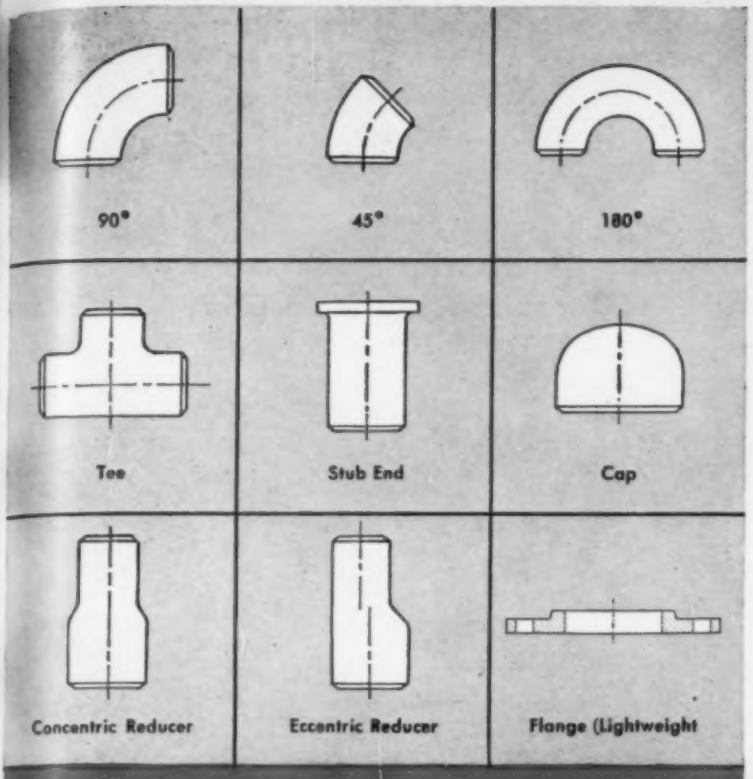
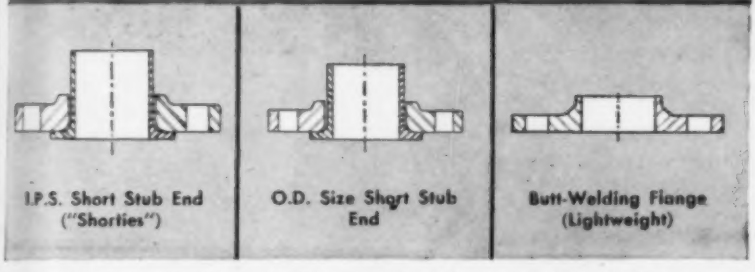


A NEW SLANT ON FLANGED CONNECTIONS



Seamless stub ends for 10-S and 40-S piping with 150 lb. A.S.A. carbon steel lap joint flanges.

Seamless stub ends for O.D. tubing sizes with 150 lb. A.S.A. carbon steel lap joint flanges.

Lightweight stainless flanges (125 lb. American Standard diameter and drilling) for butt-welding to Schedule 10-S pipe.

TAYLOR FORGE WeldELLS and FLANGES

UNIFORMLY EXCELLENT

. . . . for conditions requiring:
Product Purity
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Extremely High Temperatures
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Maximum Economies

Available in Stainless 304, 316, 347, Monel, Inconel, Nickel, Copper; also other usual industrial metals.

Fitting sizes: ¾" through 12" and larger. Wall thicknesses: schedules 40S, 80S, 10S and others. Flange sizes: ¾" through 30" and larger.

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District Offices—New York: 50 Church Street • Philadelphia: Broad Street Station Bldg. • Chicago District Sales: 208 S. LaSalle Street
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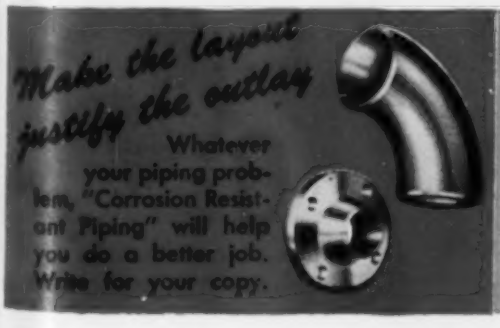
Make the layout justify the outlay
Whatever your piping problem, "Corrosion Resistant Piping" will help you do a better job. Write for your copy.

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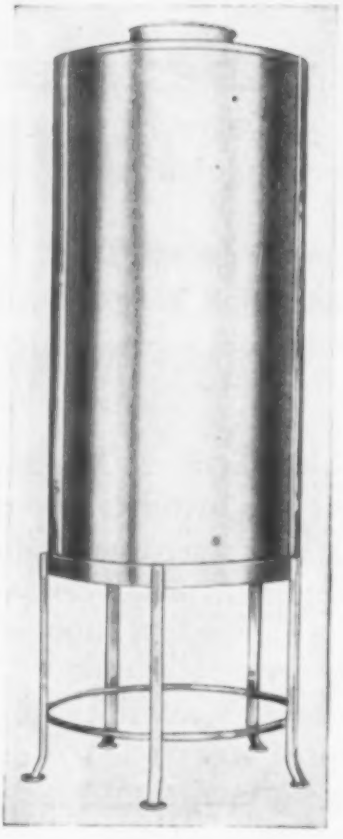

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tion, Rutgers University, has joined the staff of the Dorr Co. as assistant to the chief sanitary development engineer.

Cary R. Wagner is now vice president in charge of operations of General Aniline & Film Corp. For the past year, vice president in charge of research and development, Dr. Wagner was for many years research director of Pure Oil Co. and during the war he was a member of the staff in the Office of Petroleum Coordinator for War.

C. R. Wagner

W. von Fischer

William von Fischer, acting head of chemistry since March, has been appointed head of the chemistry and chemical engineering department at Case Institute of Technology, Cleveland.

Francis Frary, director of research, Aluminum Co. of America, has been elected to receive the Gold Medal of the American Society for Metals for 1948. The medal is to be presented to this year's winner during the National Metal Congress and Exposition in Philadelphia October 25-29. Dr. Frary, the fourth scientist to receive the medal since its inception in 1943, is widely known for his specialized studies in both metallurgy and chemistry.

M. P. Drumond has been made works manager of the Denver Chemical Co. plant of Colorado Fuel & Iron Corp. Drumond was formerly with CF&I's chemical engineering department at Pueblo.

A. B. Ordway has been appointed to the executive staff handling the overall policies of the Kaiser Co. industries. He was previously vice president and general manager of the iron and steel division.

H. W. Bialkowsky has been chosen director of research by Weyerhaeuser Timber Co., Longview, Wash., succeeding **Raymond S. Hatch**, retired.

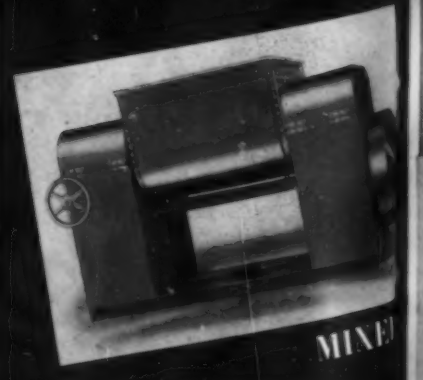
Henry Ostrowski has been elected chairman of the technical section of the Pacific Coast branch, Canadian Pulp & Paper Association. Ostrowski

EACH ONE THE BEST FOR ITS PURPOS

PAUL O. ABBÉ

JAR MILL

PEBBLE MI



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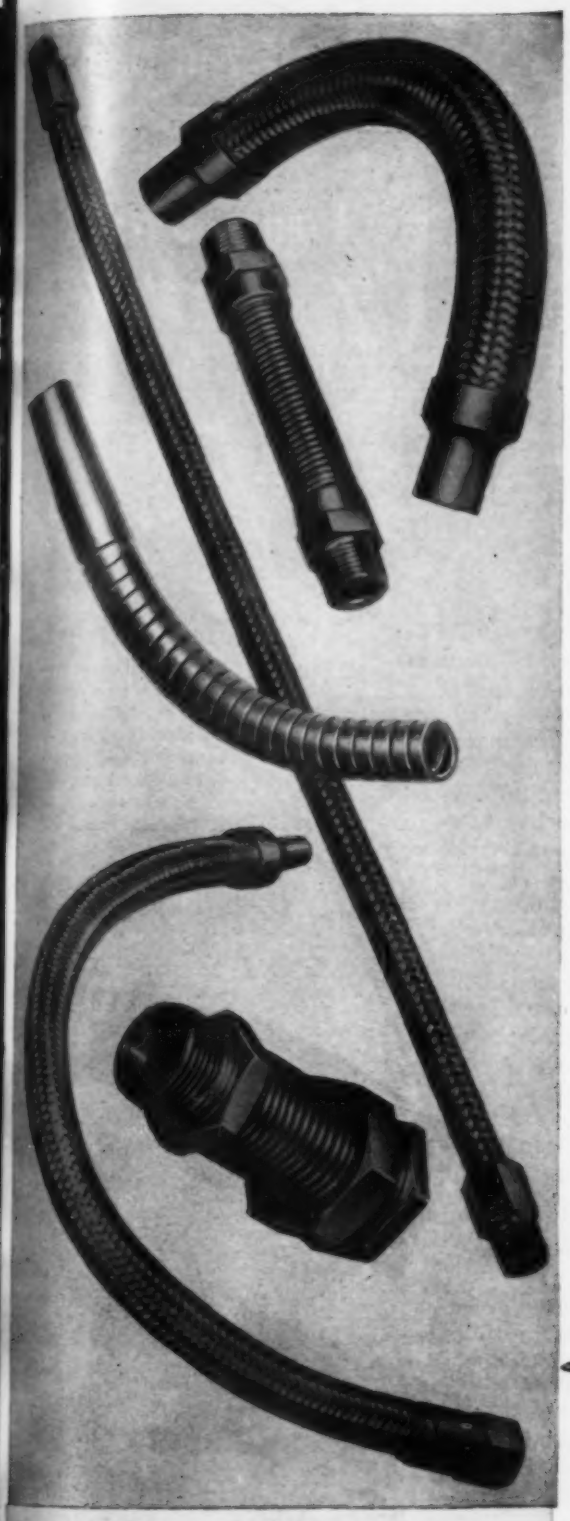

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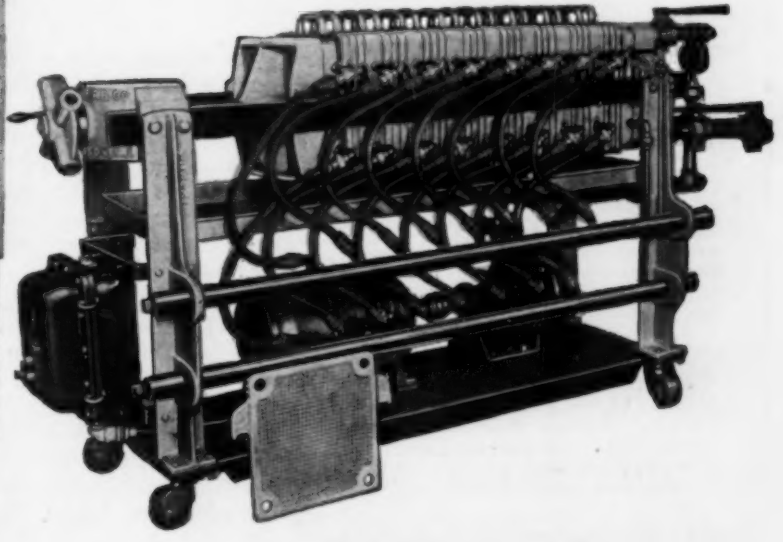

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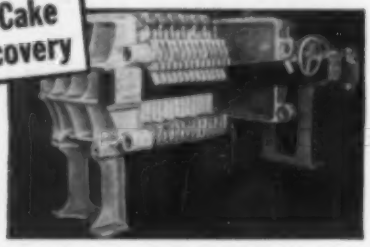
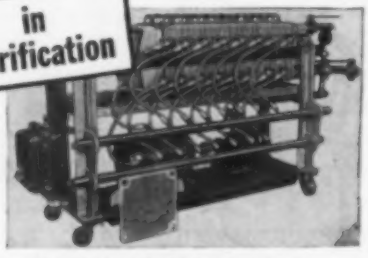


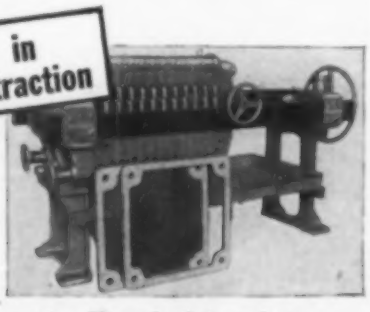
They produce filter cakes of any size, thickness and number, built up at any required pressure; firm, and dry enough to process or dry in subsequent equipment.

in Clarification



They produce in any desired volume at any flow rate, liquids of crystal clarity and purity, at any temperature or pressure, regardless of viscosity, thickness or color of slurry.

in Extraction



They produce filter cake that can be partially or thoroughly washed, steamed, extracted, leached, redissolved or melted right in the filter press.

Shriver Filter Presses are built of any material to process 1,000 gallons of slurry, for any pressure to 1,000 p.s.i., using any filter medium. Match that kind of design and performance versatility with any other kind of processing equipment, if you can.

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is technical control supervisor at the Ocean Falls, B. C., mill of Pacific Mills, Ltd.

Wilber O. Teeters has been appointed director of research of Sun Chemical Corp. to succeed **Paul V. McKinney**, resigned.

Ernest F. Thoenges, manager of Sunflower Ordnance Works, operated by Hercules Powder Co. at Lawrence, Kan., has retired.

H. F. Wakefield of the engineering department of the Bakelite Corp., New York, is now chairman of the North Jersey section of the American Chemical Society. He succeeded **Ira D. Garard**, head of the chemistry department of the New Jersey College for Women.

Herbert Fineberg has been appointed chief chemist of the Glyco Products Co.

Allen B. Stowe, head of the Kalamazoo College chemistry department, has been elected chairman of the Kalamazoo section of the American Chemical Society, succeeding **Eugene H. Woodruff** of the Upjohn Co.

Therald Moeller, associate professor of chemistry at the University of Illinois, has been elected chairman of the University of Illinois section of the American Chemical Society, succeeding **Harold R. Snyder.**

Sidney W. Fox of the Iowa Agricultural Experiment Station and Industrial Science Research Institute of Iowa State College has been elected chairman of the Ames section of the American Chemical Society.

Roy H. Kienle, assistant director of research of the Calco Chemical Division of American Cyanamid Co., Bound Brook, N. J., and **Charles P. Neidig**, in charge of market research on chemical products for Atlantic Refining Co., Philadelphia, have just been appointed councillors-at-large of the American Institute of Chemists.

Albert L. Lehninger, assistant professor of biochemistry in the University of Chicago department of surgery and biochemistry, received the $1,000 Paul-Lewis Laboratories Award in Enzyme Chemistry at the national meeting of the American Chemical Society in Washington, August 30.

Wilbur L. Nelson, head of the department of petroleum refining of the University of Tulsa, spent the month of August in Bogota and Barranca Ber-

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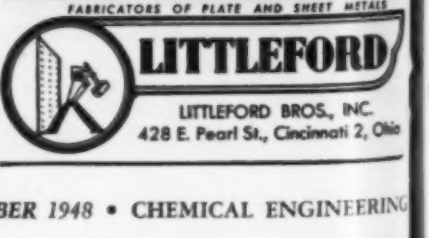

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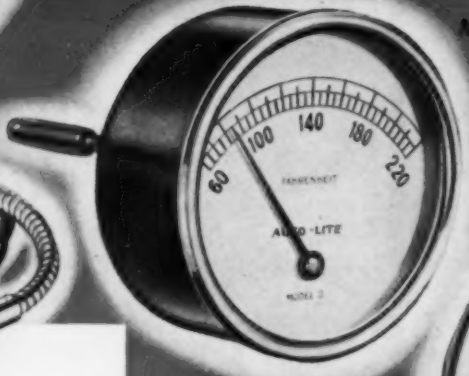

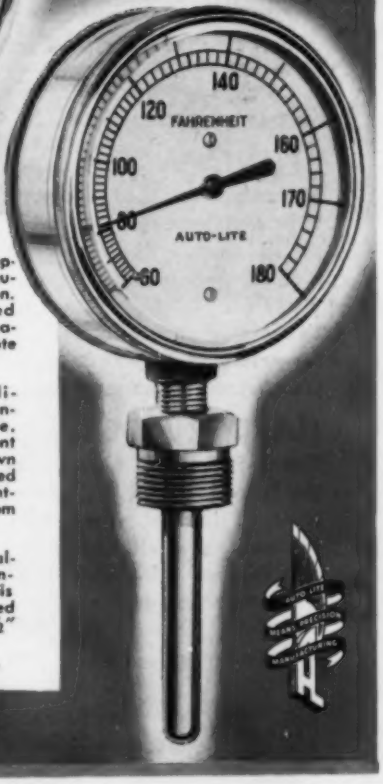

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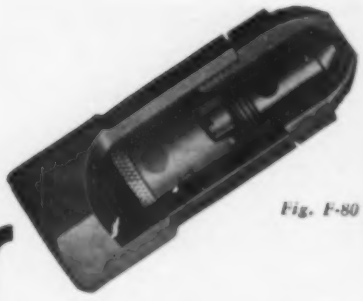

Fig. F-80

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meja, Colombia, and in Caracas, Venezuela, as a consultant on refining conditions in these two countries.

G. E. McKenna has been promoted to the position of superintendent of the Borger Refinery of Phillips Oil Co. McKenna's appointment fills the vacancy created by the death of **R. D. Evans.**

Nicholas Russin, graduate student in chemistry at Carnegie Institute of Technology, has been awarded a Monsanto Chemical Co. graduate fellowship.

R. I. Peters

H. W. Redshaw

Rolland I. Peters has been appointed technical director of the Ditzler color division, Pittsburgh Plate Glass Co., succeeding **M. G. Bell** who left to enter business for himself as a Ditzler jobber in Seattle. **Harold W. Redshaw** was named assistant technical director.

Duane L. Kenaga has joined the Southern Research Institute of Birmingham, Ala., technical staff in the wood and paper division.

John W. Snyder has been appointed technical director of Binney & Smith Co.

Nathaniel D. Hill has accepted a position with the Griscom-Russell Co.

Robert W. Shortridge, formerly with Midwest Research Institute, has joined Commercial Solvents Corp. in its research and development department at Terre Haute. Other additions to the staff include **Harold I. Yalowitz, Walter E. Gerard, John T. Craig, Robert R. Bennett, Emory E. Toops, Jr.**, and **Zachariah C. Dameron, Jr.**

Richard J. Kaul, former assistant in charge of chemicals to the manager of New Jersey refineries, has been appointed manager of the operations and planning division of the chemical products department of Esso Standard Oil Co.

William K. Mohney, assistant chief plant chemist of the Meadville, Pa., plant of the American Viscose Corp., has been elected chairman of the Erie

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section of the American Chemical Society. He succeeds **Harold M. Slate**, assistant professor of chemistry at Allegheny College.

Robert U. Haslanger has been promoted to assistant to the general manager of the Western division of Monsanto Chemical Co. in Seattle.

Ralph A. Krause has joined Stanford Research Institute, Palo Alto, as director of research. He was formerly assistant to the president of Raytheon Manufacturing Co., Waltham, Mass.

Willard H. Dow has been elected to receive the American Society for Metals Medal for the advancement of research for 1948.

Alan S. Michaels and **James N. Addoms** have been appointed assistant professors in chemical engineering at the Massachusetts Institute of Technology, and **Lockhart B. Rogers**, assistant professor in chemistry.

Carl F. Prutton has announced the formation of Carl F. Prutton & Associates, Inc., Cleveland, for consultation, research and development in the fields of chemistry and chemical engineering. Associated with him are **Clark D. Miller** and **Leon R. Westbrook.**

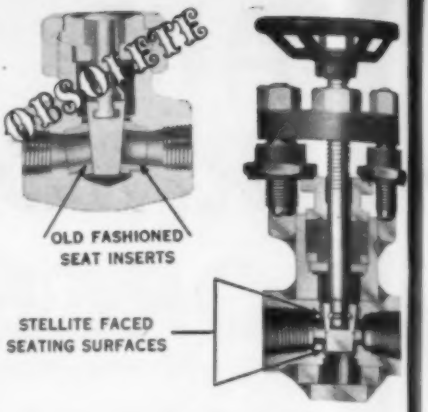
Henry T. Ward, former professor of chemical engineering and department head at the University of Arkansas, has been appointed head of the department of chemical engineering at Kansas State College.

G. E. Hilbert

L. B. Howard

G. E. Hilbert has been named chief of the Bureau of Agricultural and Industrial Chemistry, effective October 1, succeeding **Louis B. Howard** who has resigned. Dr. Hilbert goes to Washington from Peoria where he has been director of the Bureau's Northern Regional Research Laboratory. Dr. Howard will head the recently formed department of food technology at the University of Illinois.

J. M. Graham, Jr., has been appointed assistant director of Monsanto Chemical Co.'s general engineering depart-



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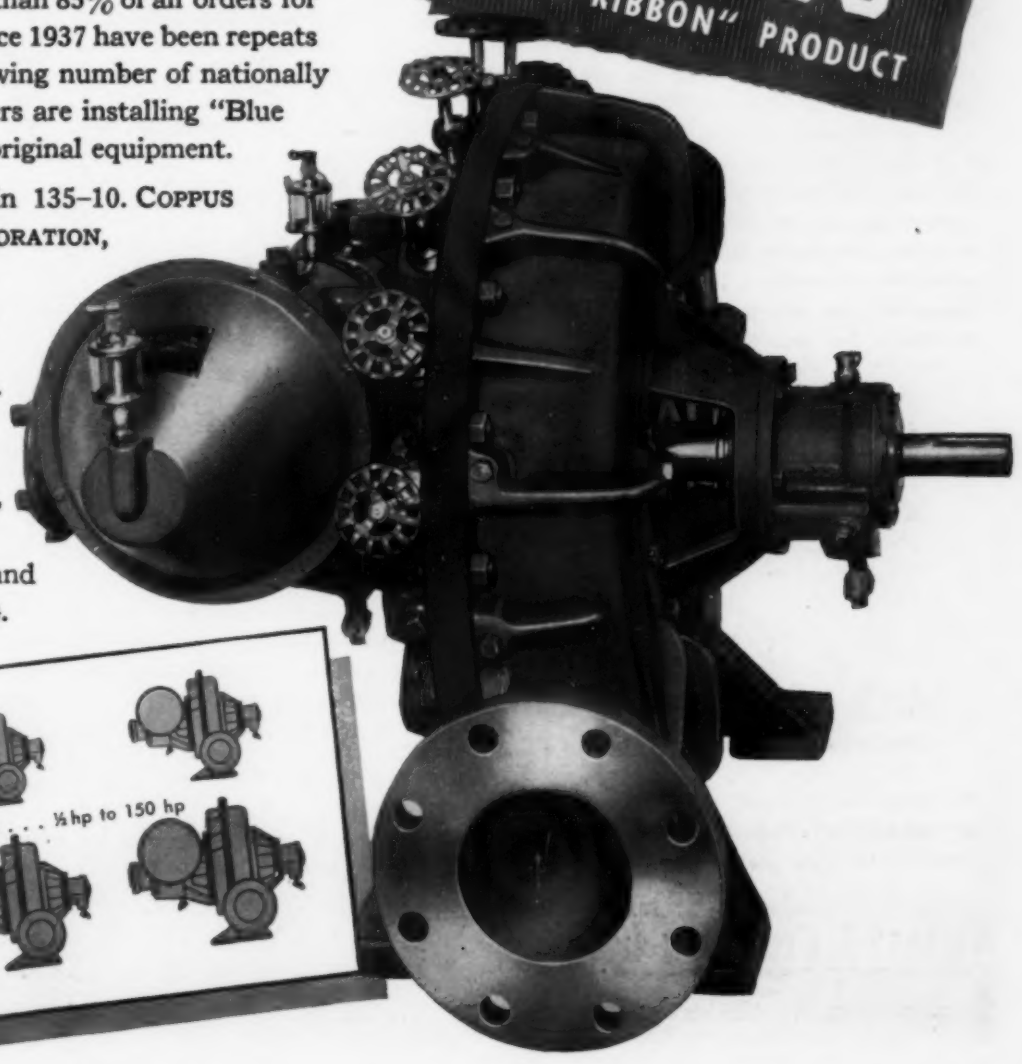

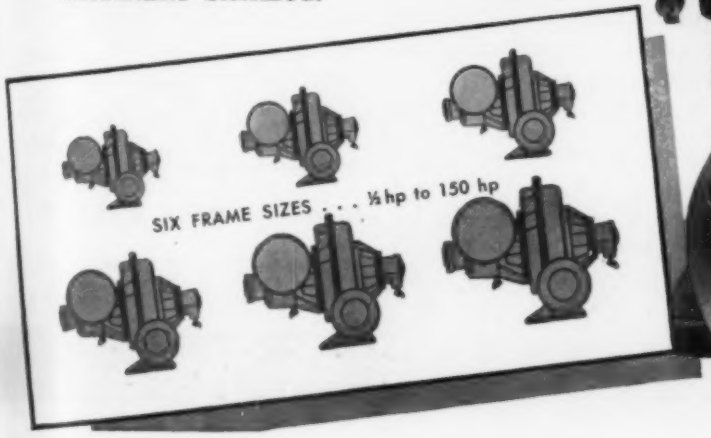

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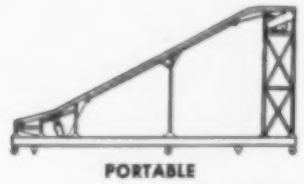

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ment. Graham, who has been serving as manager of the department's process section, will continue to direct the latter section.

Richard P. Wascher has been promoted from section leader to assistant director of engineering, in the chemical division of Corn Products Refining Co., Argo, Ill.

Edward Wichers, formerly assistant chief and head of the section on reagents and platinum metals, National Bureau of Standards, has been appointed division chief to succeed Dr. Lundell who has retired. At the same time **William Blum,** head of the electrode position section, was designated assistant chief of the division.

Franklin Wedge, former eastern manager for Ansul Chemical Co., has been appointed assistant to the president. He has moved from Philadelphia to the company's main office at Marinette, Wis.

Richard S. Schreiber, research supervisor at the Du Pont Experiment Station, Wilmington, Del., has been elected chairman of the Delaware section of the American Chemical Society. He succeeds **Raymond F. Schultz,** director of the Hercules Powder Co. Experiment Station, Wilmington.

Truman P. Kohman and **Robert G. Parr** have joined the department of chemistry of the Carnegie Institute of Technology. Both men will hold the rank of assistant professor. Dr. Kohman will teach nuclear chemistry; Dr. Parr, theoretical chemistry.

A. H. Hayes has been promoted to assistant general superintendent of the Whiting, Ind., refinery of Standard Oil Co. (Indiana) to succeed **J. C. Ducommun.**

J. Horace Coulliette has been appointed technical director of the Industrial Research Institute of the University of Chattanooga.

A. C. Monteith, engineering executive of the Westinghouse Electric Corp., has been elected vice president in charge of engineering and research.

OBITUARIES

J. K. Moore, supervisor in the cellulose products division of the Hercules Powder Co. experiment station in Wilmington, died July 13.

Lyle M. Geiger, 35, director of research of the Neville Co., Pittsburgh, died August 19.

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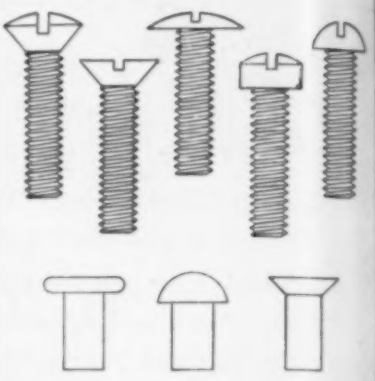
Stainless Steel MACHINE SCREWS and Rivets



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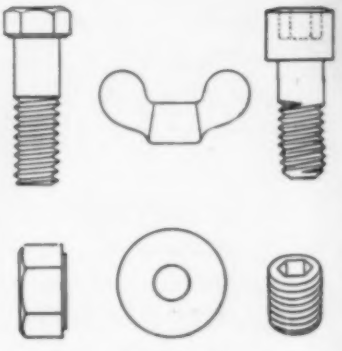

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THERMOFOR PYROLYTIC CRACKING PROCESS...

...a high temperature thermal cracking process, by which ethylene and aromatic hydrocarbons are economically obtained in quantity from low-grade petroleum oils and light hydrocarbons.

...similar to Socony's famed T.C.C. process extensively used in producing high-grade gasoline and distillate fuels.

...employs a moving bed of solids as a heat transfer medium capable of withstanding extremely high temperatures and rapid cooling.

...features a self-cleaning arrangement whereby the carbon deposits are utilized to generate heat required in the operation.

Address inquiries to Vulcan . . . Cincinnati, Ohio.

VULCAN

THE VULCAN COPPER & SUPPLY CO. General Offices and Plant: CINCINNATI, OHIO

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CANADA — VICKERS-VULCAN PROCESS ENGINEERING COMPANY, LTD. — MONTREAL

no chemical can attack TEFLON PACKING

for pumps and valves

• *for example:*

Ciba Pharmaceutical Products, Inc., uses Pfaudler glass-line 300-gal. reactors in their Pyribenzamine plant at Summit, N. J. For more than a year these reactors have been equipped with Style #101 Plastic Teflon Packing, and Teflon Gaskets. During that time of continuous use, excellent results have been obtained. Teflon Packing and Gaskets have shown no noticeable deterioration whatsoever.

Ciba also uses Teflon Jacketed Gaskets extensively throughout their plant, with equally satisfactory results.

• *styles*

No. 101 Plastic Teflon Packing—compounded with Graphite.

No. 201 Plastic Teflon Packing—compounded with Mica. This style for use with stainless steel

Gaskets covered with pure teflon. All styles thoroughly tested. Withstand any corrosion conditions at temperatures from —80° F. to 525° F.

Teflon packings are compounded by a process which reduces the friction found in pure teflon, yet retains all its chemical resistance.

• *80 . . .*

wherever, whenever you have a nasty packing or gasket problem, call on

POWER PRODUCTS CO.

11 Broadway New York 4, N. Y.

INDUSTRIAL NOTES

Stanolind Oil and Gas Co., Tulsa, has named C. J. Tighe as field project engineer in charge of the construction of a gasoline plant near Ulysses, Kans.

Stauffer Chemical Co., New York, has added Harry J. Miller to its sales staff.

Hewitt-Robins, Inc., Buffalo, N. Y., has appointed Charles W. Mackett manager of sales operations for the Hewitt Rubber division.

Freeport Sulphur Co., New York, has elected R. Kirby Shirley executive vice-president and Pearson E. Neaman, vice president and general counsel.

N. I. Malmstrom & Co., New York has appointed James L. Johnson to its sales staff in Chicago, Ill.

Hammel-Dahl Co., Providence, has made the Republic Supply Co. of Los Angeles its West Coast representative.

Merck & Co., Inc., Rahway, N. J., has named Edward J. Nolan as plant manager. Frank Tritschler has been named to succeed him as manager of manufacturing.

Formica Co., Cincinnati, is the new name of the Formica Insulation Co.

National Carbide Corp., New York, has elected J. Carl Bode operating manager president.

E. I. du Pont de Nemours and Co., Wilmington, has appointed Frederic A. C. Wardenburg as director of sales of the pigments department.

American Car & Foundry Co., New York, has appointed Hermon E. Warren, Jr., to represent the valve division with headquarters in Atlanta, Ga.

Dayton Chemical Products Laboratories, Inc., Dayton, Ohio, has moved its operations to West Alexandria.

Chemical Pump and Equipment Corp., New York, has been formed to represent manufacturers specializing in chemical processing equipment. Territory covered is New York State east of Rochester and western Connecticut.

International Minerals & Chemical Corp., Chicago, has elected A. Norman Into and Maurice H. Lockwood

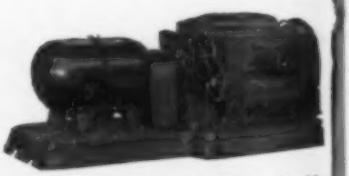
FROM THE LAB . . . TO THE PLANT

there's an AMERICAN to fit each crushing job

American Laboratory Mills provide the required action—and exact reduction for pilot plant or laboratory operation, as well as afford an excellent means of sizing soluble or fibrous residues for sewage disposal.

To obtain the highest efficiency on every crushing operation, American Crushers are custom-built to handle *specific* reduction requirements. From small capacity laboratory mills and plastics scrap grinders to large capacity mills for high tonnage reduction Americans assure dependable uniform sizing, and long, trouble-free service.

American "KC" Plastics Grinders rapidly reduce thermoplastic sprues, gates and rejects to uniform, granular size with minimum fines—assuring proper mold flow. Capacities to 450 pounds per hour.



With American's exclusive shredder rings, these AC Ring Mills give high tonnage reduction at low cost. Capacities to 500 TPH.

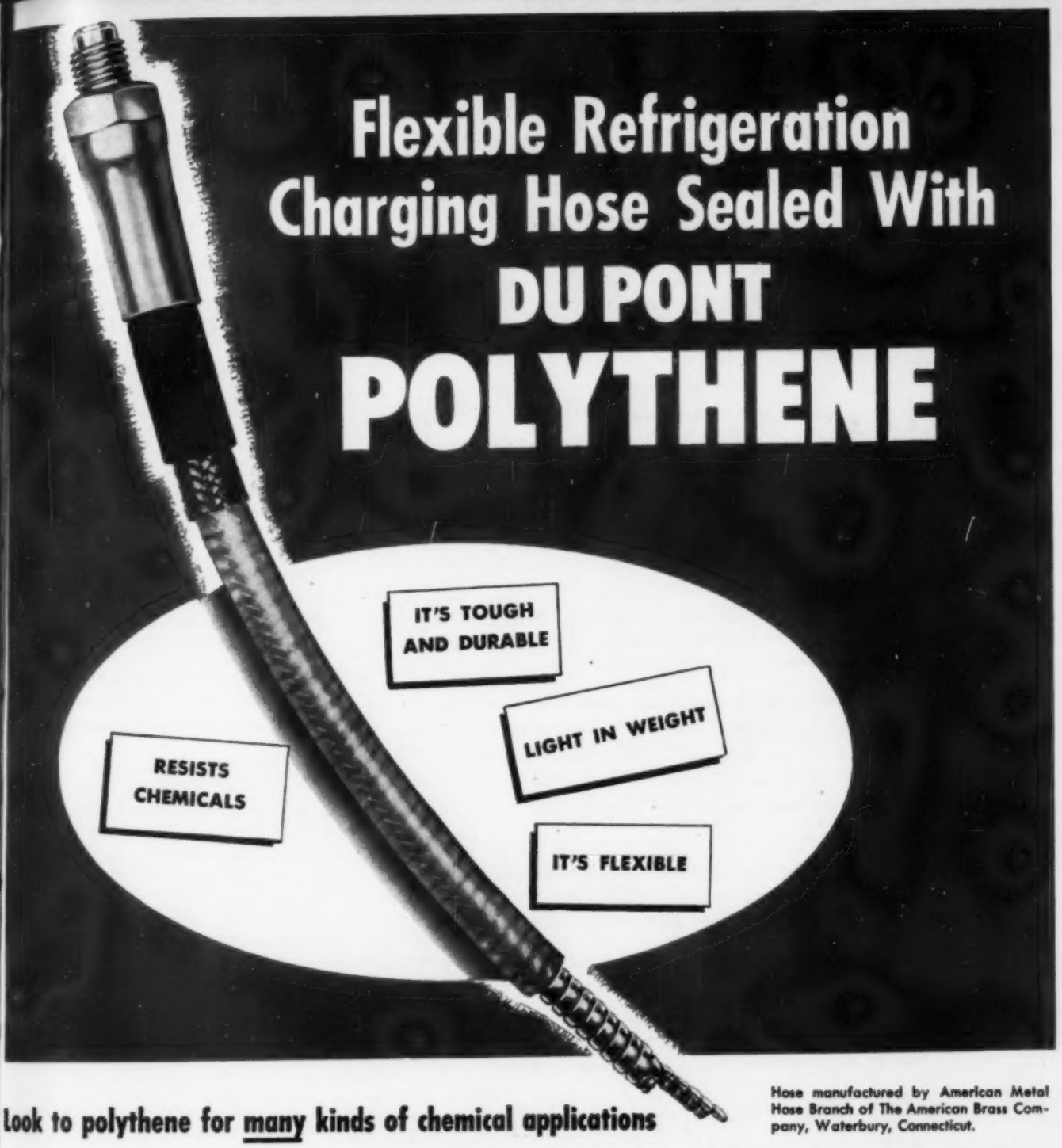
Write for information on the complete line of Americans.

American PULVERIZER COMPANY

Originators and Manufacturers of Ring Crushers and Pulverizers

1219 Macklind Ave. St. Louis 10, Mo.

Flexible Refrigeration Charging Hose Sealed With DU PONT POLYTHENE



Hose manufactured by American Metal Hose Branch of The American Brass Company, Waterbury, Connecticut.

look to polythene for many kinds of chemical applications

Here's a new hose designed to withstand the high pressure and chemical action of refrigerant gases... yet light, flexible, and small enough to be coiled and carried in the tool kit.

Although the flexible strip-wound stainless steel core provides strength, it's not leak-proof. That's why it is covered with a seamless extruded inner seal of polythene. For polythene has low permeability to methyl chloride, sulfur dioxide, and "Freon" refrigerants. Its properties of resilience, strength and durability keep the hose in service long after other types fail.

Du Pont polythene has many other outstanding properties. It won't shatter or smash . . . is tasteless, odorless, non-toxic . . . has unusually high dielectric strength. At room temperature, there's no known solvent for polythene.* What's more, it's readily molded or extruded. Perhaps polythene can solve many of *your* material problems. Write for full information. E. I. du Pont de Nemours & Co. (Inc.), Plastics Department, Room 109, Arlington, N. J.

* *Polythene swells on long exposure to some reagents, such as chlorinated solvents.*

DU PONT
REG. U. S. PAT. OFF.
Plastics
BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY

Match your Painting Problems against these SOLVED by Prufcoat*

Corrosion Case History #325

Corrosion Case History #326

Corrosion Case History #327

Corrosion Case History #328

Sulfuric Acid Concentration Plant, troubled with costly corrosion, applied Prufcoat protective coatings and reports: ***"Prufcoat on floors and pump supports — good after two years of service."***

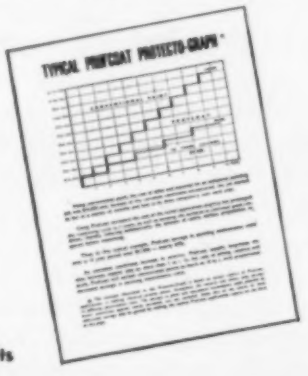
Muriatic Acid Fumes were eating concrete in a well-known acid plant. After repeated failures, Prufcoat was tried. 6 years later their job report reads: "Painted concrete piers and beams that were subjected to muriatic acid fumes with Prufcoat and to date have ***noticed no further deterioration of the concrete."***

Plating Room Fumes are death to ordinary coatings. So this large plating plant tried Prufcoat on various surfaces subject to corrosion. Their report: "Only coating found to withstand action of hot plate solutions and ***remain in good condition for two years."***

50% Caustic Soda Solutions are carried in tank cars owned by this large plant. After repeated coating failures, Prufcoat was applied. Result: "Prufcoat . . . ***unaffected by spills and drips after two years continuous service."***

Yes, in plant after plant Prufcoat is solving tough maintenance painting jobs involving corrosion from acids, alkalies, oil and water. Try this performance-proved protective coating yourself. Apply Prufcoat on machinery, equipment, pipes, walls, floors — ***any metal, masonry or wood surface.*** See how it ***stops corrosion cold, saves your equipment, cuts painting maintenance costs.***

****Taken from actual reports on file at Prufcoat Laboratories, Inc.***



You, too, can save . . . Write for proof!

Yes, the Protecto-Graph plan proves—*with your own figures* — that you can cut costly corrosion, save painting maintenance costs in your plant. Write for your copy *today.*

PRUFCOAT LABORATORIES, INC.
63 Main Street • Cambridge 42, Massachusetts

Seven attractive colors that apply like paint to metal, masonry or wood

SAVES MORE BECAUSE IT PROTECTS MORE

vice presidents of the corporation. Mr. Into is in charge of the company's potash division; Mr. Lockwood is in charge of the plant food division.

Bailey Meter Co., Cleveland, has appointed H. T. Sawyer manager of its Buffalo office. K. E. Atwood has succeeded Sawyer as manager of the Seattle office.

Joshua Hendy Corp. has appointed Ralph S. Drummond manager of its division, Crocker-Wheeler Electric Mfg. Co., Ampere, N. J.

Glidden Co., Cleveland, has purchased 50 acres of land at Macon, Ga., and plans to build three factories there.

General Electric Co., Pittsfield, Mass., has appointed Harold F. Smiddy general manager of the chemical department.

Goodyear Tire & Rubber Co. Akron, has established a chemical division. Herman R. Thies has been named to head up the new division.

Babcock & Wilcox Tube Co., Beaver Falls, Pa., has appointed William J. Thomas general sales manager.

Dorr Co., New York, N. Y., has made William E. Smith assistant manager of its North American sales division with headquarters in New York. He has been succeeded as manager in Canada by Cyril Hewson Knight.

A. E. Staley Mfg. Co., Decatur, Ill., has appointed Paul D. Doolen as industrial sales manager. Richard L. Nagle has been named division manager of industrial sales.

National Lead Co., New York, has elected D. A. Merson and Harry C. Wildner vice presidents. Both are directors and members of the executive committee.

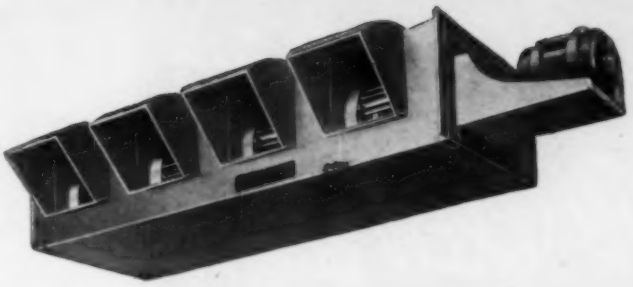
Michigan Chemical Corp., Saint Louis, Mich., has appointed R. A. Bondurant, Jr., general manager.

Allis-Chalmers Mfg. Co., Milwaukee, has named P. F. Bauer manager of a newly formed central region of its general machinery division with headquarters in Cleveland. A sixth region for the same division's field organization has been organized under William Arthur.

Minneapolis-Honeywell Regulator Co., Minneapolis, has appointed Howard Marston industrial manager of the Brown division of the company in Minneapolis and St. Paul. Earl S.

"LOWBOY"

can be suspended out of the way, sends all the heat you want, where you want it.



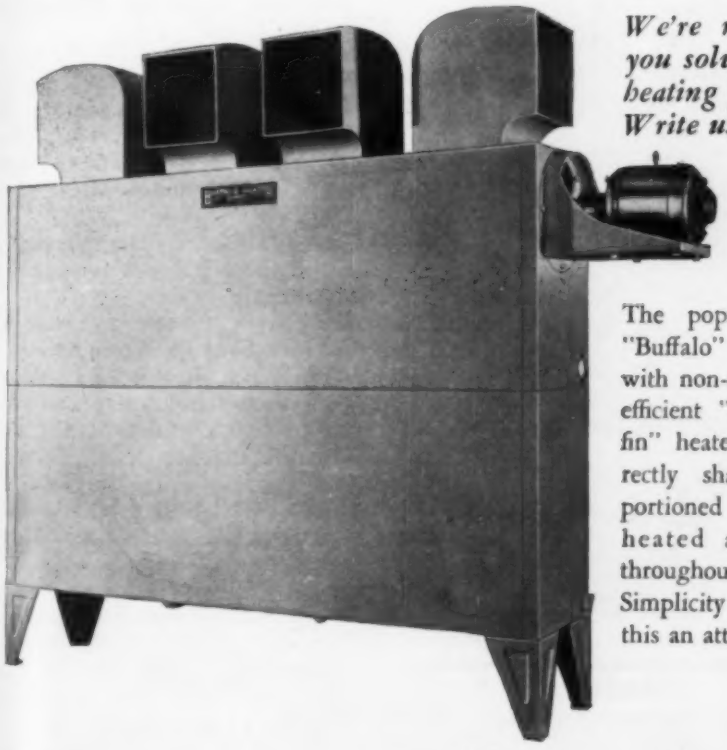
FANS by "Buffalo"

Now! Get set on

HEATING FOR DEPENDABLE WINTER COMFORT

Now is the time to make sure your plant will have adequate heat next winter for employee health and process temperature control.

For the large areas, where you need up into the million b.t.u.s, the "Buffalo" Heaters shown here do a very adequate, quiet, economical job. They operate on from 2 lbs. to 150 lbs. steam. *For the smaller areas* specify the compact, highly efficient Model "C" Breezo-Fin Unit Heaters. These easily-installed suspended models have adjustable louvers.



We're ready to help you solve your winter heating problem now! Write us for the facts.

"HIGHBOY"

The popular floor type "Buffalo" Heating unit with non-corrosive, highly efficient "Flexitube Aerofin" heater element. Correctly shaped and proportioned outlets diffuse heated air effectively throughout working area. Simplicity of line makes this an attractive unit, too.

EQUIPMENT FOR

- ★ VENTILATING
- ★ HEATING
- ★ COMFORT COOLING
- ★ PROCESS COOLING
- ★ AIR TEMPERING
- ★ AIR WASHING
- ★ EXHAUSTING
- ★ BLOWING
- ★ FORCED DRAFT
- ★ INDUCED DRAFT
- ★ PRESSURE BLOWING
- ★ CLEANING
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Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

Branch Offices in All Principal Cities

UTTING AIR COSTS IN EVERY BRANCH OF INDUSTRY

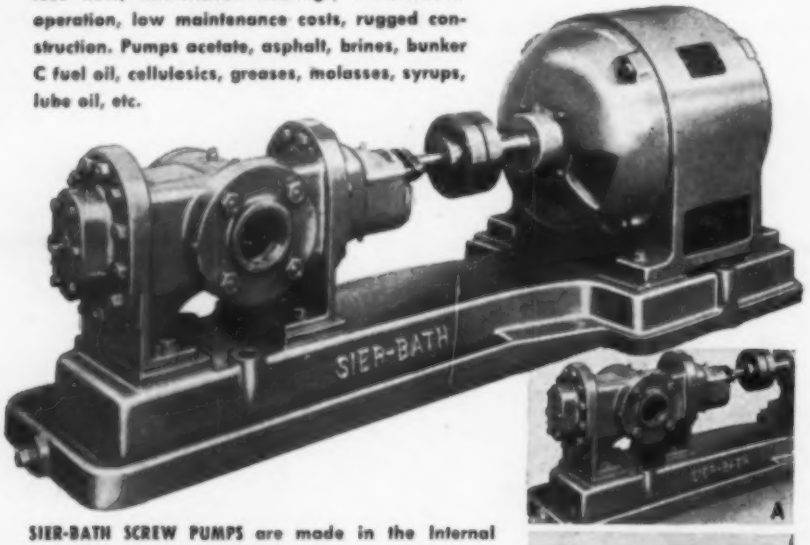
Viscosity means nothing to SIER-BATH SCREW PUMPS

IF you handle fluids so viscous that they are likely to "gum up the works"—it is time for you to look at Sier-Bath Screw Pumps. Nothing beats the thrust of the screw—whether it be the propeller that drives an enormous ship, or the screws in powerful Sier-Bath Screw Pumps.

Having no reciprocating parts, the flow of liquid is continuous . . . no pulsation or fluctuation of pressure, no vibration, no wear-and-tear on pipe joints and connections. Maintenance is reduced to a minimum.

Sier-Bath Screw Pumps can be obtained either in the horizontal model or, where space limitations require, in the vertical model. Send for Bulletin S-3 for complete information.

SIER-BATH SCREW PUMP ADVANTAGES: Pulseless flow, anti-friction bearings, vibrationless operation, low maintenance costs, rugged construction. Pumps acetate, asphalt, brines, bunker C fuel oil, cellulosics, greases, molasses, syrups, lube oil, etc.



A

SIER-BATH SCREW PUMPS are made in the Internal Gear Type (A) for liquids having viscosity enough to lubricate the timing gears and bearings. It is also made in the External Gear Type (B) where liquids of non-lubricating value such as water, distillates, hot oils, etc., are handled.

ALSO MAKERS OF SIER-BATH PRECISION GEARS

FOUNDED 1905 **MEMBER A. G. M. A.**

Sier-Bath
GEAR and PUMP CO., Inc.

9259 HUDSON BOULEVARD • NORTH BERGEN, NEW JERSEY

Bush has been named Chicago industrial sales engineer for the steel industry for the Brown division. Larry E. Singleton will succeed Bush as the Chicago branch industrial service manager. I. K. Farley has been appointed industrial manager of the Houston, Tex., branch, Brown division.

Rust Engineering Co., Pittsburgh, has been authorized by Socony-Vacuum Oil Co., Inc., to act as engineer-constructor for units to produce ethylene and aromatics by Socony's Thermfor Pyrolytic cracking process.

Clifford B. Ives & Co., Philadelphia, has been formed to represent manufacturers in eastern Pennsylvania, southern New Jersey and Delaware.

Edward Valves, Inc., East Chicago, Ind., has started construction on a new building to house the metallurgical, physical and chemical laboratories.

Eastman Kodak Co., Rochester, N. Y., has purchased from General Mills, Inc., the latter's interest in Distillation Products Inc., Rochester.

Chas. Pfizer & Co., Brooklyn, has made the first carload shipments of citric acid from its new plant in Groton, Conn.

Paraffine Companies, Inc., San Francisco, has officially made the Plant Rubber and Asbestos Works, formerly a wholly owned subsidiary, into its insulation division.

Falk and Co., Pittsburgh, has purchased the Northwest Linseed Co. of Minneapolis.

E. I. du Pont de Nemours and Co., Wilmington, has opened headquarters for its district sales offices at a building erected for them at 427 Fourth St., Wilmington.

Duraloy Co., Scottdale, Pa., has appointed J. B. Dear as assistant sales manager.

White-Roth Machine Corp., Lorain, Ohio, has elected George L. Roth as president.

Thermoid Co., Trenton, N. J., has appointed A. Ray MacPherson manager of its industrial friction materials sales division.

Hercules Powder Co., Wilmington, has made Paul L. Lefebvre assistant manager of the synthetics department's market development division. J. Glenn Little replaces Lefebvre as district manager for synthetics in Chicago.

Many Happy Returns

ADDRESSOGRAPH-MULTIGRAPH CORP. • • AMERICAN ENKA CORP.

THE BORDEN COMPANY • • CARBIDE & CARBON CHEMICALS CORP.

CORN PRODUCTS REFINING CO. • • • • CORNING GLASS WORKS

GENERAL ELECTRIC CO. • • • • • • • GENERAL FOODS CORP.

HOOKER ELECTROCHEMICAL CORP. • • • OSWEGO FALLS CORP.

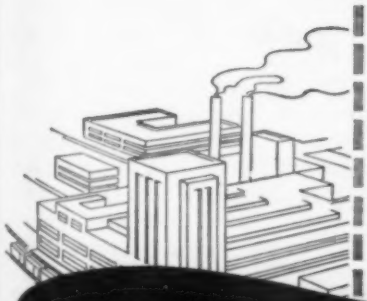
THE PROCTER & GAMBLE CO. • • RADIO CORPORATION OF AMERICA

SOUTHERN ALKALI CORP. • • • • • • A. E. STALEY MFG. CO.

This month—as we begin our thirty-first year as industrial engineers and builders—an amazingly high percentage of our business continues to be *repeat* business.

These many happy returns of satisfied customers include leaders in practically every field of industry. Shown above are the names of a few for whom we have done repeat jobs just since World War II.

One reason why clients return to us time and time again: They like the *quality* of our work. And they like the savings in time and money which result from *one* contract and *one* responsibility. *You* will, too. Why not call, wire, or write our nearest office? There is no cost for our preliminary recommendations and estimates, and they may be valuable tools in planning for the future.



The H.K. Ferguson Co.
INDUSTRIAL ENGINEERS AND BUILDERS

CLEVELAND • The Ferguson Building • Phone CHerry 5870
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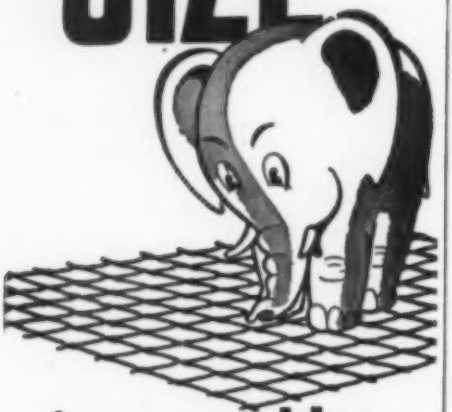
UNDER ONE CONTRACT AND ONE RESPONSIBILITY, WE DESIGN, BUILD, AND EQUIP OUTSTANDING ANTIBIOTIC LABORATORIES . . . RESEARCH LABORATORIES . . . FOOD PROCESSING PLANTS . . . RAYON PLANTS . . . PAPER MILLS . . . ATOMIC ENERGY PLANTS . . . CHEMICAL PROCESS PLANTS OF ALL KINDS . . . INDUSTRIAL PLANTS . . . POWER PLANTS. WE ALSO FURNISH ENGINEERING REPORTS AND SURVEYS.

MESH SIZE



is no problem

for JELLIFF

For quality wire mesh — contact Jelliff — makers of wire mesh products for over sixty years. Commercial sizes available in standard lengths of 100 feet and widths of 24 to 72 inches. Meshes of specified gauge and weave made and cut to order. Available crimped, calendered and rolled. Jelliff engineers keep abreast of current developments in new alloys, coatings and processes and apply them when studying your requirements. For best results and maximum economies, look to Jelliff.

Write Dept. 204 for Literature

• LEKTROMESH • RESISTANCE WIRE •
• DIPPING BASKETS • WIRE MESH PARTS
The C. O. JELLIFF MANUFACTURING CORPORATION
SOUTHPORT, CONN.
WIRE PRODUCTS
Jelliff
SINCE - 1860
• WIRE CLOTH • STRAINERS • FILTERS •

CONVENTION PAPER ABSTRACTS

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Resinography

RESINOGRAPHY was proposed as the name for the graphic study of structures in resins and their plastics. The term is analogous to metallography and mineralography. Like them, resinography is concerned with microscopical structure and its correlation with other physical and chemical properties involved in the production, fabrication, performance, or failure of the material.

Resinography is concerned with the structure of resins and plastics both inside and out, both macro and micro and both physical and chemical. If the material is laminated the method will tell how many layers, how thick, how uniform, and probably what they are made of. The layers may vary from a thin film of varnish or electroplate (less than 1 mil thick) to paper, wood boards (0.25-in. thick). If the plastic contains pigments or fillers, resinographic examination will tell about the size, shape, and distribution of the individual particles and often at least something about the nature of the filler. If the filler is of botanical origin, the method will tell whether the material is from the bark, wood, or fruit and often it will classify the botanical origin. If the filler is mineral a great deal of information can be had about the origin of the mineral and its probable physical and chemical properties. If the filler is synthetic it is

BOWEN ENGINEERING, INC.
GARWOOD, NEW JERSEY

HERE IS A "CUSTOM-BUILT" SPRAY DRYER NOW AVAILABLE IN A WIDE CHOICE OF SPECIFICATIONS

On a "package unit" basis

PRODUCTION:	5 to 20 tons per day.
CONSTRUCTION:	Mild or stainless steel—fits into a single 20' bay.
HEATER:	Oil, gas, steam—direct or indirect.
CHAMBER:	10' diameter, 70° cone bottom.
ATOMIZATION:	Patented atomizers for coarse or fine particles—New design Bowen Spray Machine, speed ranges 6,000 to 20,000 R.P.M., interchangeable parts.
COLLECTORS:	Single or multiple stage cyclones with optional bag filter or Bowen Venturi Washer.
TERMINAL BOARD:	Completely instrumented for automatic control.
DELIVERY:	Approximately four months.

THIS SPRAY DRYER IS IDEAL FOR REGULAR PRODUCTION, PILOT OPERATIONS OR MARKET SAMPLING.

Write for fully illustrated bulletin

Recognized Leaders in Spray Dryer Engineering Since 1926

A New Role for the HORTONSPHERE

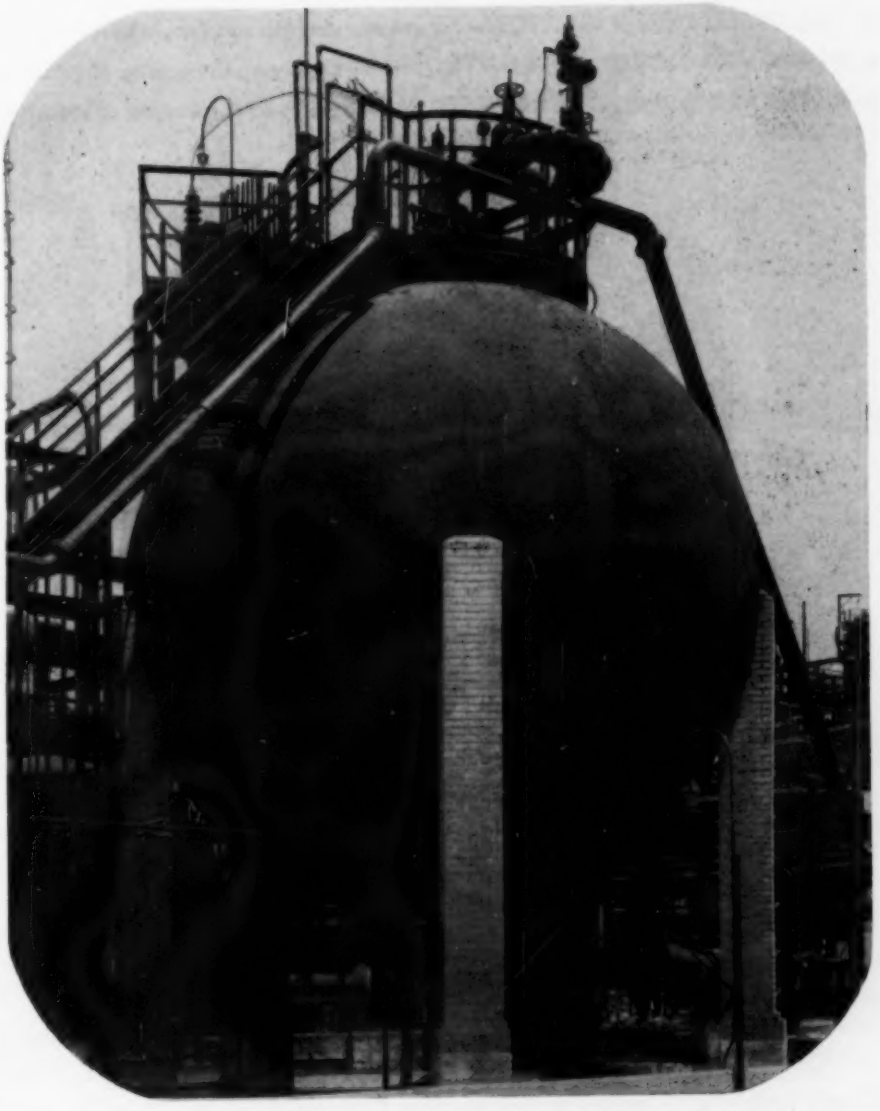
– This time it's a DESALTER

The versatile Hortonsphere has been adapted to a new job in the petroleum field—as an electric desalter for crude oil. The Hortonsphere is the tank well known as a pressure storage unit for highly volatile petroleum product, such as the more volatile grades of natural gasoline, butane, butane-propane mixtures, and volatile refinery charging stocks. In standard sizes of 1,000 to 25,000 bbls. it is commonly used to store liquids under pressure from 25 to 100 lbs. per sq. in. and has been built in smaller sizes to store propane at pressures up to 250 lbs. per square inch. Other industries use the Hortonsphere to store products such as anhydrous ammonia, hydrogen and carbon monoxide, and it is used by sewage disposal plants as a holder for sewage digester gas, valuable as fuel.

As a desalter, the Hortonsphere is combined with an electrical unit developed by the Petroleum Rectifying Company. It is designed to remove salt from crude oil before the crude is charged into a cracking unit. Crude with a high salt content causes a serious reduction in efficiency and output of refinery units and necessitates frequent shut-downs.

In the desalting process, the salt-bearing crude charging stock passes through heat exchangers, is mixed with hot, fresh water and passed through an air-operated emulsifier. The mixture, usually 95 per cent oil and 5 per cent water, flows into the Electrosphere where it enters a high-voltage electric field. The water and brine particles are electrically attracted and coalesced, and the coalesced masses settle by gravity to the bottom of the sphere to be drawn off.

The Electrosphere is just one special application of the Hortonsphere. When you need steel tanks for special jobs, send specifications to our nearest office.



The Hortonsphere shown above, fitted with an electric desalting unit, was installed at the Gulf Oil Corporation's Port Arthur, Texas refinery. The salt-bearing crude is heated to 180 deg. F. before desalting, and is mixed with 5% of water by volume heated to a temperature of 160 deg. F. An average of 16,248 bbls. of crude per day is desalted by this unit. The salt content of the crude is about 38 lbs. per 1,000 bbls., of which the desalter removed 93.9 per cent.

CHICAGO BRIDGE & IRON COMPANY

Birmingham 1.....1510 North Fiftieth St.
Houston 2.....2103 National Standard Bldg.
Tulsa 3.....1623 Hunt Bldg.
New York 6.....3318—165 Broadway Bldg.
Cleveland 15.....2220 Guildhall Bldg.
Los Angeles 14.....1405 Wm. Fox Bldg.
Chicago 4.....2124 McCormick Bldg.
San Francisco 11..1222-22 Battery Street Bldg.
Philadelphia 3..1625-1700 Walnut Street Bldg.
Atlanta 3.....2120 Healey Bldg.
Havana.....402 Abreu Bldg.
Detroit 26.....1503 Lafayette Bldg.
Boston 10.....1005-201 Devonshire St.
Salt Lake City 1.1505 First Security Bank Bldg.
Seattle 1.....1305 Stuart Bldg.

Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY and GREENVILLE, PENNSYLVANIA

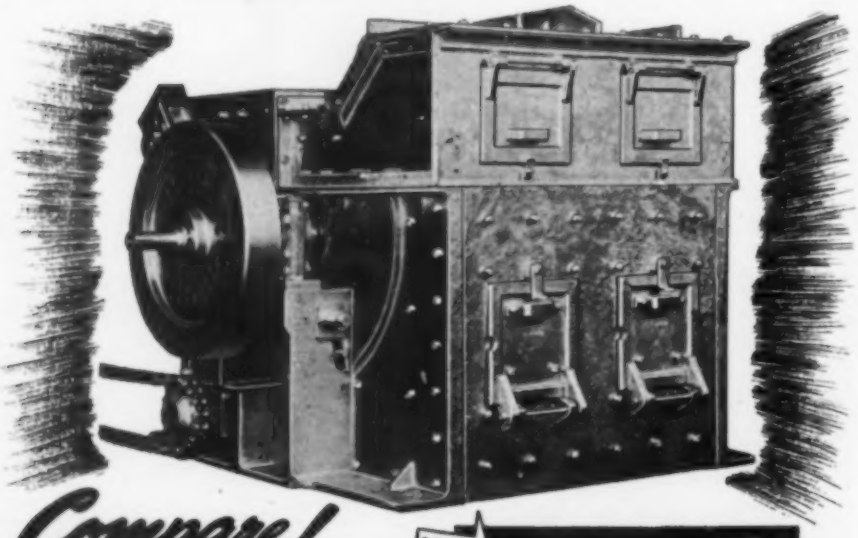
NEW! IMPROVED!

"36 SERIES"

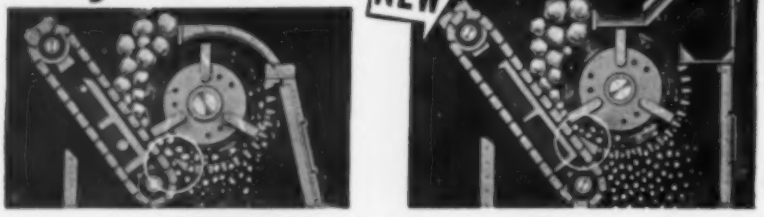
DIXIE HAMMERMILL

(With the continuously Moving Breaker Plate*)

- **ALL STEEL CONSTRUCTION**—for greater strength . . . longer life
- **IMPROVED GRINDING CONTROL**—for unvarying uniformity of product
- **EXTENDED MOVING BREAKER PLATE**—sets new standard of crushing efficiency in the reduction of wet, sticky material.



Compare!



Note by comparing *before and after* diagrams, above, how the new, Extended Moving Breaker Plate guards against the passage of oversize material between breaker plate and front cage bar—also how added space between cage bars and back of mill assures unrestricted flow of material.

These and other unique, money-saving features make the Dixie Hammermill now, more than ever before, your guarantee of *greater production at less cost.*

WRITE TODAY FOR COMPLETE DETAILS.

*U. S. Patents Granted and Pending.

DIXIE

MACHINERY MANUFACTURING CO.

Main Office and Plant

4172 GOODFELLOW BLVD. ST. LOUIS 20, MO.

Foreign Office: 104 Pearl St., New York, N. Y.

usually identified both chemically and physically and oftentimes with respect to the method of manufacture.

Natural resins have been identified as to species and state of hardness by using the polishing, staining, and etching techniques of the metallographer. Work is going on now using similar methods to identify synthetic resins which contain no clues from pigments, fillers, color, or chemical properties.

The information which is being gathered is used in the search for and development of new resins, the expansion of uses for old resins, trouble shooting, placing of responsibility in civil and criminal legal cases, purely scientific research and sometimes just to satisfy ordinary curiosity.

T. G. Rochow, American Cyanamid Co., before Division of Analytical and Microchemistry, American Chemical Society, Portland, Sept. 14, 1948.

Saran

CHEMICAL resistance of saran (polyvinylidene chloride thermoplastic) to most organic and inorganic materials makes it particularly adaptable for use in pipe and fittings for the handling of highly corrosive liquids. The strength of saran for its many industrial uses is the result of the properties of the normal crystalline polymer. In its manufacture it is crystallized from the amorphous state and oriented for greater strength.

Saran is extruded in a conventional screw type extruder modified for better streamlining and more thorough melting of the plastic. Tubing, pipe and filaments are made in this fashion. The tubing and pipe are used in industrial processing particularly where saran's chemical resistance is of advantage. The filaments are woven into household screen cloth, fabrics and filter cloths. The film is being used for packaging chemicals. Injection moldings are used for parts in rayon manufacturing equipment, atomizer heads, acid dippers and similar types of equipment.

D. R. Williams, Dow Chemical Co., before Knoxville-Oak Ridge Section, American Institute of Chemical Engineers, Knoxville, May 22, 1948.

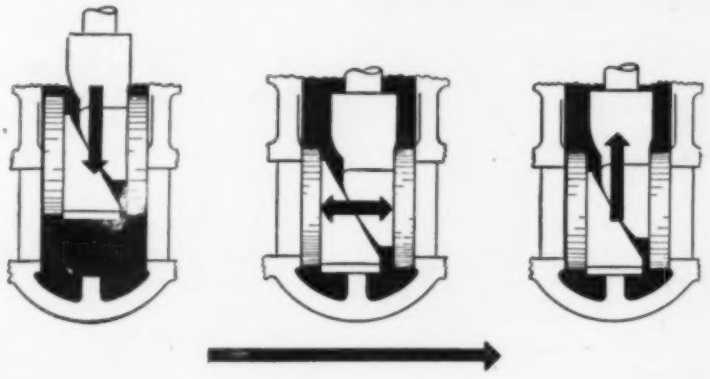
Teaching Chemical Industry Fundamentals

WHEN an industry is extremely varied, as is the chemical industry in Texas, the individual student cannot be trained in all the aspects of that industry. He must get a training in fundamentals applicable to all these aspects and must become familiar with some of the ways in which the fundamentals are used.

In the chemical engineering cur-

Ingenuity in gate valve design fulfills seven objectives*

ELIMINATION OF DISC-TO-SEAT FRICTION AND GALLING

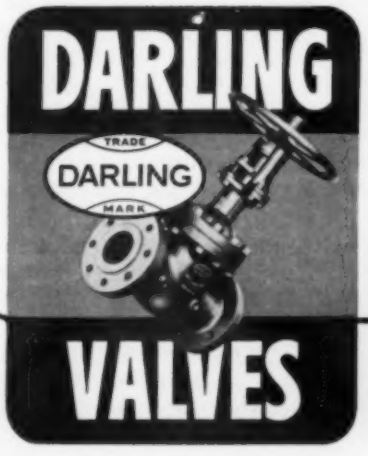


THOUSANDS of valves are ruined every year because their design makes it necessary to "jam" them shut and "break" them open. The valve discs and seats are subjected to severe friction and galling, a major cause of leaks, unreliable performance and excessive maintenance cost.

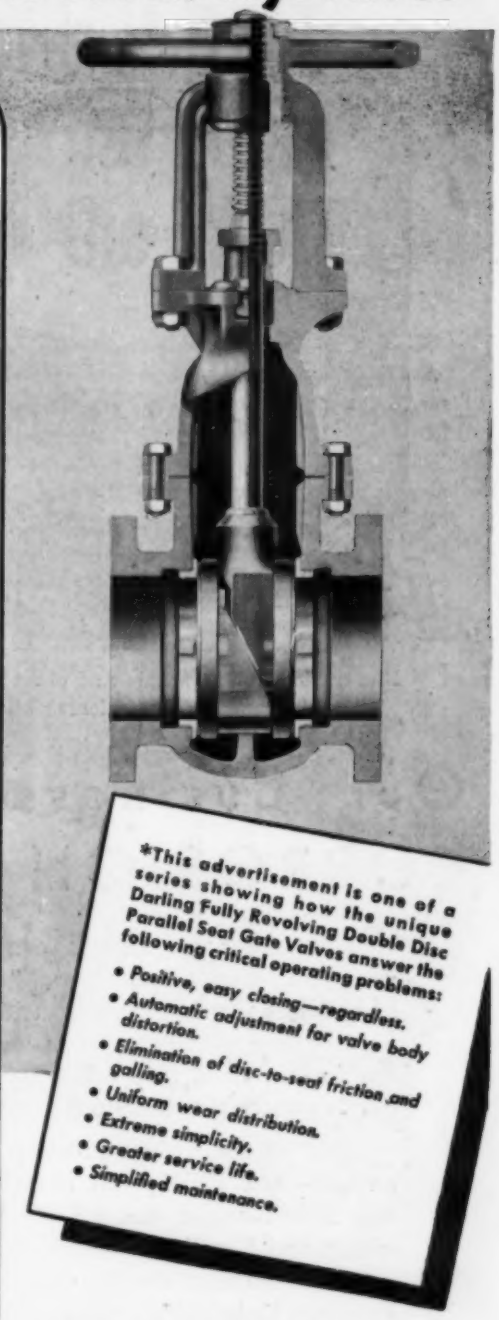
The above sketches show how this condition has been completely eliminated in the unique design of Darling Fully Revolving Double Disc Parallel Seat Gate Valves. The discs are lowered all the way with minimum disc-to-seat friction. Next, the positive wedging action spreads the discs for tight contact against their seats. When opening the valve, the first turn of the stem completely releases wedging pressure on the discs.

This is a unique, positive release feature—one of the principal reasons why hundreds of users have found Darling Valves so reliable and easy to operate—sure to last longer, with minimum maintenance cost.

DARLING VALVE & MANUFACTURING CO.
WILLIAMSPORT 3, PA.



Outline your needs and ask for specific data on the proper Darling Valves . . . or send for the complete 300-page Darling Catalog No. 17M. It describes Darling Valves of *all* types and is full of valuable information.



*This advertisement is one of a series showing how the unique Darling Fully Revolving Double Disc Parallel Seat Gate Valves answer the following critical operating problems:

- Positive, easy closing—regardless.
- Automatic adjustment for valve body distortion.
- Elimination of disc-to-seat friction and galling.
- Uniform wear distribution.
- Extreme simplicity.
- Greater service life.
- Simplified maintenance.

Darling Parallel Seat Gate Valves are available in a wide range of sizes and constructions for all types of normal and unusual service, and for pressures up to 3000 pounds. Likewise, Darling Taper Seat, Solid or Slotted Wedge Gate Valves are available for most services.

CORROSION RESISTANT VALVES

In addition to conventional iron, bronze and steel constructions, Darling specializes in valves for any corrosive fluid: iron body valves with special alloy trim; iron body, rubber lined with special alloy trim; all bronze; and all special alloy. Darling's 50 years of experience in meeting unusual requirements is always at your service.

THE VALVE MARK OF QUALITY : : : WATCH FOR IT

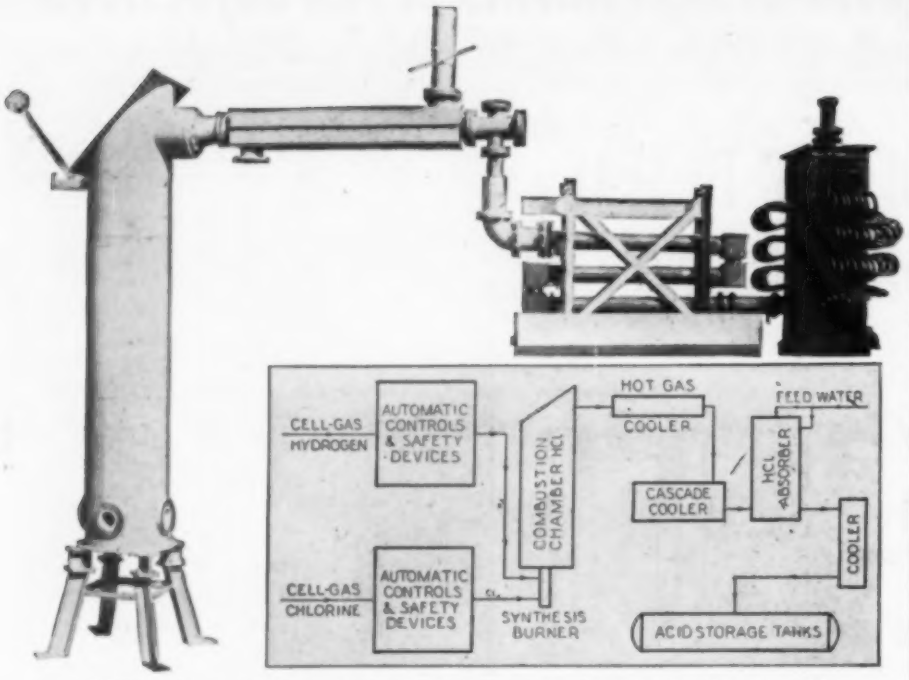


Illustration and flow sheet of plant to make 36% hydrochloric acid from chlorine and hydrogen.

Our Business Is Solving CORROSION PROBLEMS

Thru the years Knight engineers have solved a great variety of corrosion problems. With this wide experience they have designed many types of acid- and alkali-handling equipment to meet the conditions of individual customers' problems. Besides our own, they use many other types of materials to develop successful functional units.

Some of the Knight products they use are: *Knight-Ware,* an acid- and alkali-proof chemical stoneware; *Permanite,* a new resin material that is used alone or reinforced with glass fabric; and *Pyroflex,* a thermoplastic resin. Depending on the needs of the job, Pyroflex construction often includes steel, Pyroflex, Knight-Ware, Permanite, rubber, lead, glass, carbon and plastics. Thus a complete functional unit is designed by combining the best materials for a specific job.

Knight Chemical Equipment for handling corrosive chemicals is being used in just about every process industry. That is why those faced with special corrosion problems first submit them to—

MAURICE A. KNIGHT
109 Kelly Ave., Akron 9, Ohio

KNIGHT-WARE
CHEMICAL EQUIPMENT

riculum essential fundamentals are: mathematics, chemistry, physics and English. Less essential in chemical engineering but fundamental for specialized work are: economics, psychology, geology and biology.

C. G. Kirkbride has defined five technical fundamentals: the material balance, the energy balance, static equilibrium, rates of transfer and transformation of mass and energy, and the economic balance. This category is somewhat different from the usual curriculum arrangement in which emphasis is placed on unit operations and unit processes.

Economic factors should be stressed continuously in all chemical engineering courses. Economic factors should rank in importance with the technical factors.

Fundamentals of English should be and can be driven home in chemical engineering courses if the instructor stresses the need of good oral and written presentation of technical information. Unfortunately many instructors in technical subjects feel that engineering is their field and they let the instructor in English take care of his own.

Instructors can do much to give textbook vitality and meaning through presenting such material with reference to local industries. To perform efficiently, however, the instructor should have observed the operation of plants and have discussed problems with operators and management. This can be done by annual visits of faculty members to chemical plants. The visits should be technical inspections in which various units should be carefully examined and explained.

K. A. Kobe, University of Texas, before American Society for Engineering Education, Austin, Tex., June 14-18, 1948.

Aiding Research Through a Department of Research

Much thought at North Carolina State College has been given to the place of research in chemical engineering education. We think we have made progress toward the development of a fair and successful program with respect to our particular needs.

In 1946 North Carolina established the department of engineering research in the school of engineering. In this department both a staff and a group of laboratories was devoted essentially to research. The department is independent of and lateral with all other departments in the engineering school.

In consideration of the work done under state budget support, the department is concerned with the stimulus of basic research problems and certain problems relating to the use of raw materials in the state. At times a

It's the SIDES of a V-BELT That Really Get the WEAR!

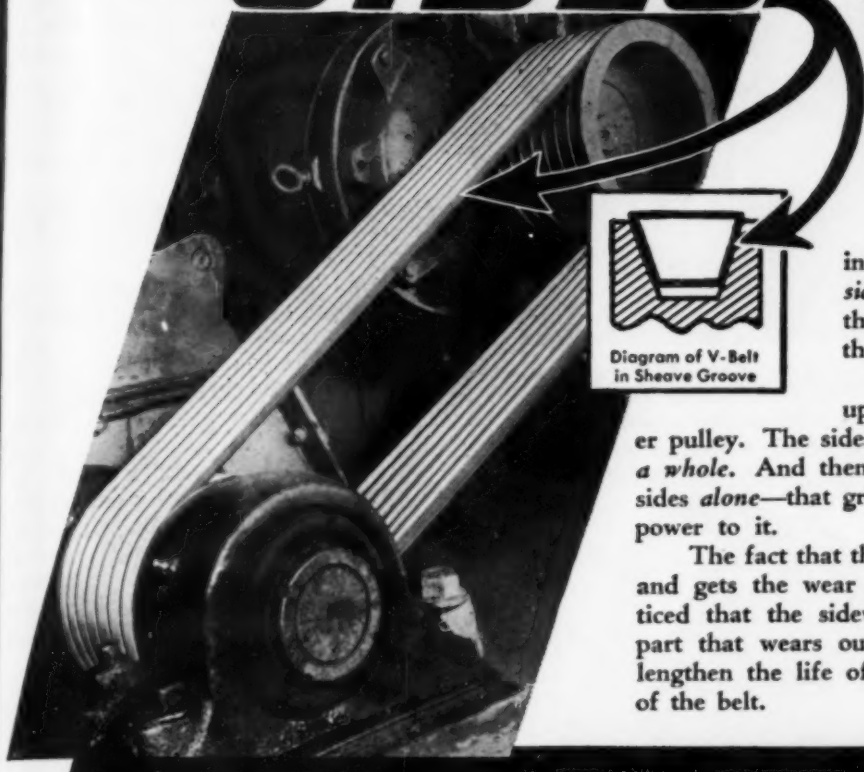


Diagram of V-Belt in Sheave Groove

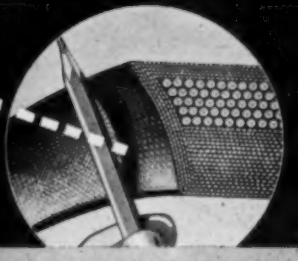
Look at this diagram of a V-Belt in its sheave. You see at once that the *sides* of the belt do all the gripping on the pulley and get all the wear against the sheave-groove wall.

It's the *sides*, moreover, that pick up all the power delivered by the driver pulley. The sides *transmit* that power to the *belt as a whole*. And then, once more, its the sides—and the sides *alone*—that grip the driven pulley and *deliver* the power to it.

The fact that the *side* is the part that does the work and gets the wear explains why you have always noticed that the sidewall of the *ordinary* V-Belt is the part that wears out *first*. Naturally, then, when you lengthen the life of the sidewall you lengthen the life of the belt.

Now See How the CONCAVE SIDE... SAVES Sidewall Wear and Lengthens Belt Life!

U. S. PATENT NO. 1813698



The simple diagrams on the right show exactly why the ordinary, *straight-sided* V-Belt gets excessive wear along the *middle of the sides*. They show also why the Concave Side *greatly reduces* sidewall wear in Gates Vulco Ropes. That is the simple reason why your Gates Vulco Ropes are giving you so much longer service than any straight-sided V-Belts can possibly give.

Saving Sidewall Wear is MORE IMPORTANT NOW Than Ever Before!

Now that Gates SPECIALIZED Research has resulted in Super Vulco Ropes capable of carrying much heavier loads—fully 40% higher horsepower ratings—the sidewall of the belt is called upon to do even more work in transmitting these heavier loads to the pulley. Naturally, with heavier loading on the sidewall, the life-prolonging Concave Side is more important now than ever before!

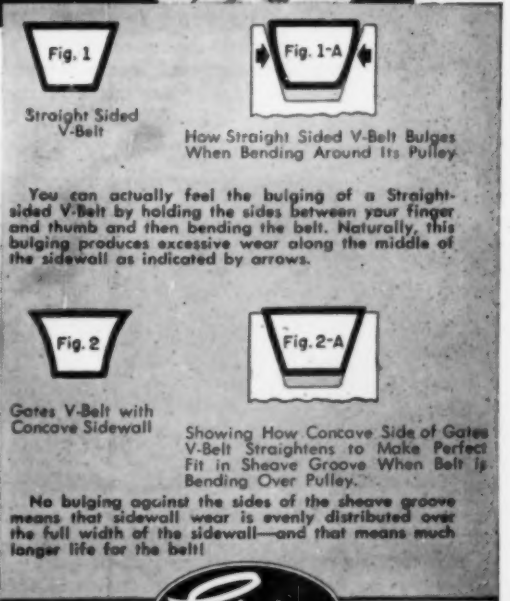


Fig. 1
Straight Sided V-Belt
Fig. 1-A
How Straight Sided V-Belt Bulges When Bending Around Its Pulley
You can actually feel the bulging of a Straight-sided V-Belt by holding the sides between your finger and thumb and then bending the belt. Naturally, this bulging produces excessive wear along the middle of the sidewall as indicated by arrows.
Fig. 2
Gates V-Belt with Concave Sidewall
Fig. 2-A
Showing How Concave Side of Gates V-Belt Straightens to Make Perfect Fit in Sheave Groove When Belt Is Bending Over Pulley.
No bulging against the sides of the sheave groove means that sidewall wear is evenly distributed over the full width of the sidewall—and that means much longer life for the belt!

THE GATES RUBBER COMPANY, DENVER, U.S.A.
"The World's Largest Makers of V-Belts"
489

GATES VULCO ROPE DRIVES
Engineering Offices and Jobber Stocks IN ALL INDUSTRIAL CENTERS of the U. S. and 71 Foreign Countries

Gates
REG. U. S. PAT. OFF.
The Mark of SPECIALIZED Research

for Effective protection against Chemical hazards . . . get WILLSON

Style No. X41

GLOVE-FIT PROTECTION AGAINST SPLASH . . . This Over-All* rubber goggle with snug fitting resilient rolled edge takes the danger out of splash and spatter; provides wearing comfort over spectacles.

Style No. 731

ONE-PIECE CAP CARTRIDGE . . . New chemical cartridge respirator with four interchangeable cap cartridge filters protects against low concentrations of specific vapors and gases. U. S. Bureau of Mines Approved.

Style No. 750D

SETTLE THE DUST PROBLEM . . . Newly approved by Bureau of Mines for all dusts. Easier breathing over long periods provided by extra large dual throw-away filters.

*Reg. U. S. Pat. Off.

For complete information on these products and their application, as well as many more eye and respiratory protective devices, get in touch with your nearest Willson distributor or write us direct.

GOGGLES • RESPIRATORS • GAS MASKS • HELMETS

DOUBLE WILLSON PRODUCTS, INCORPORATED

128 THORN ST., READING, PA., U.S.A.

faculty member in a line department may be interested in research which has requirements in equipment, labor or supplies which his department cannot furnish. In such a case a consultation is held between his department and the department of engineering research. Upon approval the project receives department support and the proponent becomes the technical director of the project. The services required are then supplied by the department.

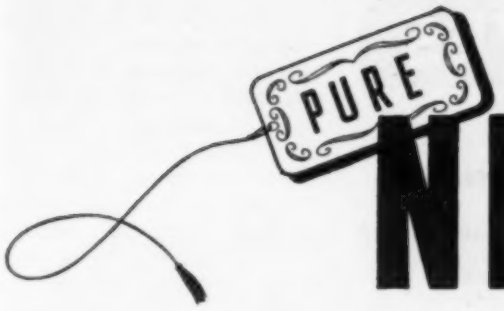
The personnel in the department is divided between staff members employed on a yearly basis and those employed under a budget classification of labor. The latter group is engaged for short periods or part time or both. Workers in this group can be assigned to aid faculty members in work on projects, and it is here that student participation can be important.

In connection with the policy on sponsored projects, it is desirable that the school be staffed and equipped so that it can accept research work of appreciable size from outside agencies when such work is compatible with the aims of the school.

W. G. Van Note, North Carolina State College, before American Society for Engineering Education, Austin, Tex., June 14-18, 1948.

One Stone, Two Birds

WATER injection, as practiced in the oil production industry, serves the dual purpose of waste brine disposal and repressuring of depleted oil formations. The operating problems involved cover a wide range, depending on existing conditions in different oil fields which govern quality and quantity of water to be handled and the nature of the underground formations into which the water must be injected. In certain fields the problem is merely one of waste brine disposal, since the brine is produced in extremely large volume and the producing formation does not respond to repressuring. In other fields the small amounts of brine produced may offer little if any disposal problem. If it is found that the producing formation is suited to water flooding, it may become necessary to supplement the waste brine supply with treated fresh water or brines produced from formations above the oil zone. The mingling of fresh waters and brines of varying salinity and character may result in troublesome plugging deposits in gathering equipment, well injection tubing and perhaps even in the underground formation itself. All possibilities of such difficulties should be given thorough study in advance of actual water injection. The results of water mingling and injection will ordinarily be readily apparent from



NICKEL

Sheet, Strip, Rod, Wire, Tubing, Clad-steel, Castings.

Its practical cost astonishes users almost as much as its distinctive characteristics

CHEMICAL COMPOSITION

The nominal composition of commercially pure wrought Nickel is:

Nickel*	99.4%
Copper	0.1
Iron	0.15
Manganese	0.2
Silicon	0.05
Carbon	0.1

**Including cobalt*

PHYSICAL CONSTANTS

Specific Gravity	8.89
Density, lb. per cu. in.	0.321
Melting Point	2615-2635°F. / 1435-1445°C.
Specific Heat at (80-212°F.)	0.130
Heat Expansion Coefficient at (80-212°F.), per °F	0.0000072
Thermal Conductivity at (80-212°F.), Btu/sq. ft./hr./°F./in.	420
Electrical Resistivity at 32°F., ohms/cir. mil. ft.	63
Temperature Coefficient of Electrical Resistivity per °F.	0.0022-0.0028
Modulus of Elasticity in tension, psi	30,000,000
in torsion, psi	11,000,000
Poisson's Ratio	0.31

MECHANICAL PROPERTIES

The following figures for Standard Cold Rolled Sheet are typical, though the figures will vary for different forms and tempers.

Tensile Strength	55,000-80,000 psi
Yield Strength (2% offset)	15,000-45,000 psi
Elongation in 2 in.	50-35%
Rockwell B Hardness	40-70

AVAILABLE FORMS

Wire, Bar, Plate, Pipe
Rod, Angles, Sheet, Strip
Seamless and Welded Tubing
Sand and Precision Castings
Clad-Steel Plate and Strip Welding Rods

It is a strange and interesting metal, Pure Nickel. A kin of both the base metals and the precious metals. Among all the elements, no other metal possesses its unique combination of so many different and uncommon properties.

- It is highly resistant to corrosives that destroy many other metals—alkalies, many acids, salts, organic compounds, fumes.
- It has mechanical properties like those of structural steel.
- Yet it is so ductile that it can be worked into the most intricate and delicate shapes that are practical in metal.
- It protects the purity of sensitive foods, beverages and pharmaceuticals against contamination.
- It often provides a faster rate of heat transfer than metals with equal heat conductivity.
- Its special electronic properties make it a standard metal for electronic uses.
- It offers rare electrical and magnetostrictive characteristics that often give theoretical ideas a birth of practical value.
- It can be exposed to temperatures ranging into yellow heat and even hotter in the absence of sulphur.
- At sub-zero temperatures its strength increases without change in ductility and toughness.
- It is a standard metal for the cladding of steel, and as a base for gold, palladium and silver-clad products.

And one of the most valuable of all its features is the fact that Pure Nickel is a practical metal at a practical price.

Does it stimulate an idea of how you may find an easy answer to a difficult problem?

Our technical bulletin "Engineering Properties of Nickel" gives the important facts you want. It's yours for the asking.

The International Nickel Company, Inc.

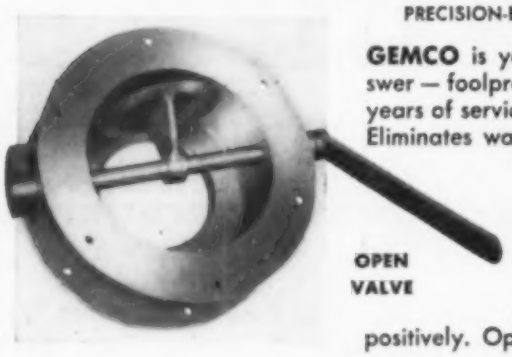
67 Wall Street, New York 5, N.Y.

GEMCO SPHERICAL DUST-TITE VALVES

Assure Improved Plant Methods on

BINS, HOPPERS, BLENDERS, PIPELINES

PRECISION-BUILT FOR *Your* JOB!



OPEN VALVE

GEMCO is your once-for-all-time answer — foolproof, efficient, built for years of service. Saves time and labor. Eliminates waste and troubles of old-style slide gate valves.

• The sharp disc cleans the seat and prepares it for smooth, quick, continuous action. Quarter-turn opens full or closes positively. Openings from 2" to 16".

Made, as per requirements, in cast iron, aluminum, stainless steel, monel, everdur, copper, or bronze.

For dry powders, crystals and pasty materials. NO STICKING, NO SIFTING, NO DUSTING.

WRITE US FOR ACTION!

General Machine Company of New Jersey

Established 1916

SPECIAL CHEMICAL AND MIXING MACHINERY • SPHERICAL VALVES

400 MARKET STREET • NEWARK 5, N. J.

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PROCESSING UNIQUE **EQUIPMENT**

HAMMER MILLS

Heavy Duty Type

Continuous full capacity production. Hard iron, interchangeable grinding plates. Self-aligning bearings. Automatic electro-magnet separator prevents tramp metals from entering grinds. Sturdy construction. Designed by experienced engineers whose reputation is founded upon doings things right. Literature available. Inquiries are cordially invited.

ROBINSON MANUFACTURING CO.

Plant: Muncy, Pa.

SALES REPRESENTATIVE

MERCER-ROBINSON COMPANY, INC.

30 CHURCH ST., NEW YORK 7, N. Y.

consideration of the chemistry of the waters to be used, together with data on the injection formation and its enclosed brine. In general, salt water is more satisfactory than fresh water for flooding relatively "tight" sandstone producing formations which contain certain clay minerals. Plugging deposits usually may be removed by various chemical or physical methods, depending on the nature and volume of the deposits. However, preventive treatment has proved more economical than remedial measures.

L. C. Case, Gulf Oil Corp., before Division of Water, Sewage and Sanitation Chemistry, American Chemical Society, St. Louis, Sept. 7, 1948.

For Export Planners

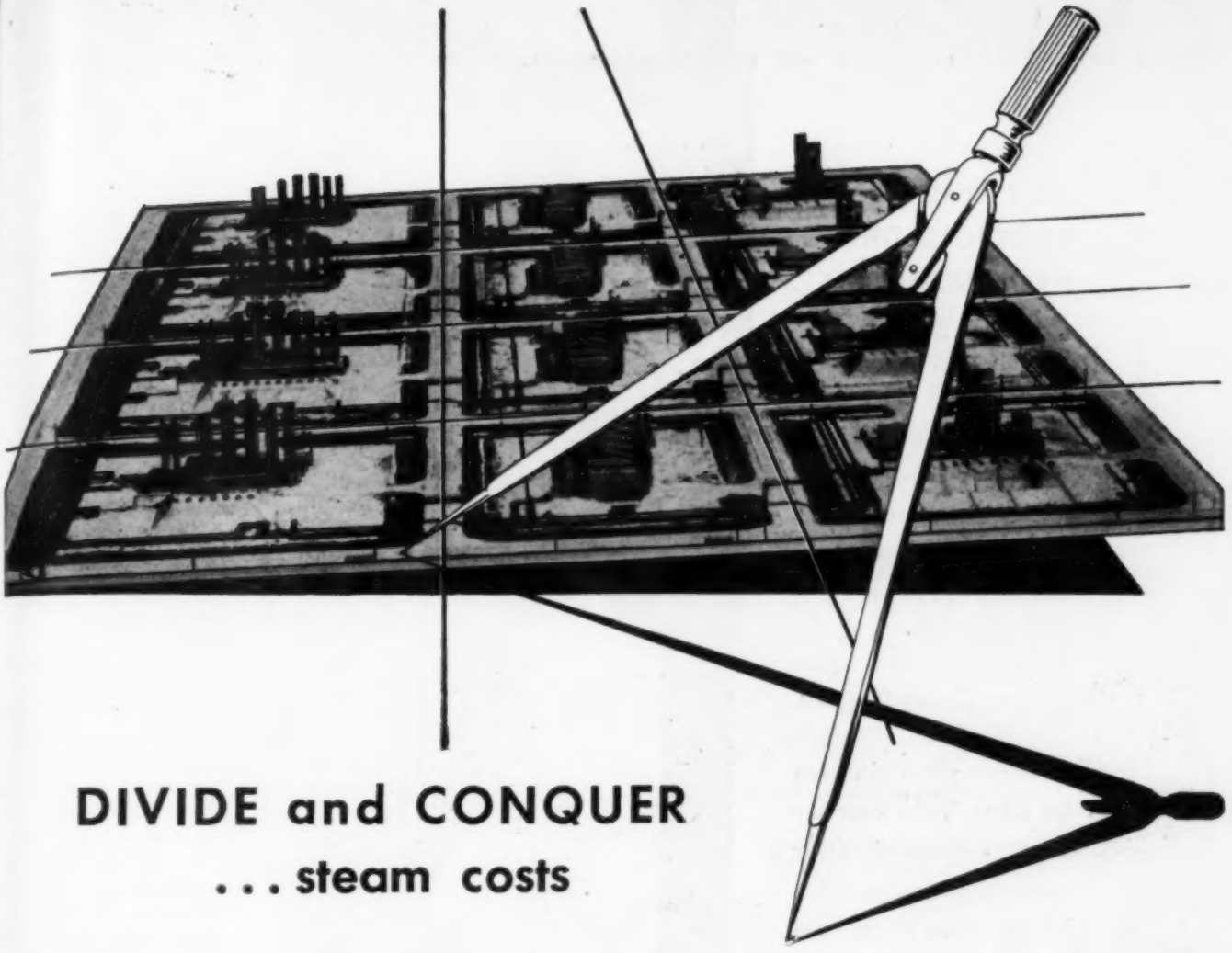
DEVELOPMENTS OF the past years have required of us and have found in this country a new state of mind in regard to foreign trade. It was not unusual in the past for a company to regard its saturation point as the capture of its just share of the domestic market. Whatever export there was for many of us was in the nature of overflow. Today every 12 jobs out if 100 in the machinery and automotive industries depend upon exports, 11 out of 100 in the rubber and chemical industries, and 18 out of 100 in the steel industry.

On the other hand, the world outside our borders has learned to think in terms of relying on our industrial potential for their salvation and prosperity. The preparedness to buy American goods is at an all-time high. Market resistance has never been lower. It follows that our capacity planning should take for granted our export sales potential, and this new mentality must pervade our thinking.

Before the war, our exports in general were handicapped by the high level of domestic prices, whereas today the American price structure compares favorably with most foreign countries. In spite of controlled or inevitable inflation abroad, the foreign purchaser, who will be able to secure the dollars for his imports, will buy as cheaply as we are willing to sell. So far, there has been no inclination on the part of our manufacturers to use the world market as a basement outlet or, on the other hand, to key up prices to the inflationary values abroad.

The financial hazards involved are rather considerable. Certain export houses will undertake to carry your financial risks.

Next is the question of government restrictions: Here we find ourselves in a maze of technicalities. The problem of dealing with the authorities which grant licenses here and



DIVIDE and CONQUER
. . . steam costs

Steam costs are hard to tackle on a plant-wide basis. Responsibility is scattered. Efficiency is unmeasured and wastes go on unnoticed.

Hundreds of plants have proven that the first step in tracking down steam wastes is to isolate steam consumption. With the knowledge of how much steam is going to each processing unit or department, inefficiencies become apparent—wastes can be conquered.

Records produced by the Brown Steam Accounting Flow Meter also form the basis for *complete cost accounting.* The Brown System records rate of flow as well as units, and provides a running total of steam consumed.

The *divide and conquer* approach to steam costs has produced sensational economies in some plants; much more than repaid the investment in practically all plants where it has been put into practice. Why not investigate the Brown Steam Accounting System now?

An informative new 32-page booklet entitled "Brown Flow Meters for Cost Accounting" has just been released. A copy will gladly be sent to you. Write for Bulletin No. 2022.

THE BROWN INSTRUMENT CO., 4478 WAYNE AVE., PHILADELPHIA 44, PA.
DIVISION OF MINNEAPOLIS-HONEYWELL REGULATOR CO.
Offices in principal cities of the United States, Canada and throughout the world

BROWN *Advanced Instrumentation* **FOR BETTER PROCESSING**
MINNEAPOLIS **Honeywell**

DE LAVAL VERTICAL DRIVE REDUCERS

A complete line of De Laval vertical speed reducers, in both single and double reductions, is available for driving agitators, mixers, and many other types of vertical shaft equipment.

If vertical drives are your problem, consult De Laval.

*This single reduction De Laval Worm Gear Reducer is available with many standard gear ratios and is but one of the 93 sizes and types of standard De Laval Worm Gear Speed Reducers.

Worm Gear Division

DE LAVAL

De Laval Steam Turbine Co., Trenton 2, N. J.

TURBINES • HELICAL GEARS • WORM GEAR SPEED REDUCERS • CENTRIFUGAL PUMPS
CENTRIFUGAL BLOWERS AND COMPRESSORS • IMO OIL PUMPS

abroad is one that requires high professional skill.

Now, add to these the difficulties of physical communication abroad. The difficulties of units in measurement, the problem of language, climatic variations, the differing species of human and technical approach. Obviously, the communion between the seller and buyer must be of a most unusual effectiveness. Nevertheless, our foreign buyer behaves very much as our own domestic customer, when something goes wrong. We are presented with the long arm of a claim, the adjustment of which is subject to the same hazard of non-communication that brought about the hazard in the first place.

In launching your export program, give primary consideration to the dissemination of technical advice along with your product.

Tino Perutz, Omni Products Corp., before the Society of the Plastics Industry, Atlantic City, May 20-21, 1948.

Fatsplitting

TECHNICAL improvements by leading soap companies have done much to soften the shock to the American soap user of the world wide shortage and high prices of fats and oils. One of the developments which has helped considerably is an entirely new method of purifying and preparing fats and oils for soap. With it, it is possible to make soaps even purer than in prewar days.

In this process, fat or oil (glycerides) is split by water to form fatty acids and glycerine. The fatty acids can then be purified and made into soap, and the glycerine can be recovered. The paper concerns itself with the factors which limit the progress of the fat splitting reaction (hydrolysis).

The limiting factor in this method of splitting oils was found to be the concentration of glycerine in the water phase. There is a definite relation between the glycerine in the water phase and the maximum percentage of fat which can be split into fatty acid and glycerine. Thus, for any given percentage of glycerine in the water there is a certain point beyond which fat splitting will not continue unless the glycerine concentration in the water phase is reduced.

Before splitting begins, each glycerine molecule is combined with three fatty acid molecules, but when the reaction has progressed beyond 90 percent the residual unsplit fat is made up of several types of glycerides. Some glycerine molecules are combined with only one fatty acid molecule, others are combined with two or

STURTEVANT *Whirlwind* AIR SEPARATORS

CUT PRODUCTION TIME AND COSTS

- **Increase production of Fines up to 300%**
- **Capacities from ¼ to 50 Tons per hour**
- **Finenesses from 40 to 325 mesh and finer**

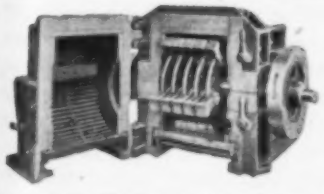
Large or small plants can increase output of accurately sized dry materials and cut costs, too, with Sturtevant Whirlwind Air Separators.

These highly efficient separators select a continuously uniform product of any desired fineness from 40 to 325 mesh and finer. Used in combination with mills, they will increase production by as much as 300% . . . cut power costs up to 50%.

Large feed opening, rugged construction, ease of adjustment, low power consumption assure economy of operation and minimum upkeep. Write for Bulletin 087 today.

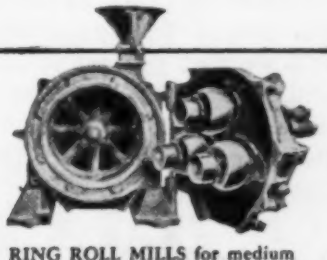
STURTEVANT MILL CO.

100 CLAYTON STREET, BOSTON 22, MASS.

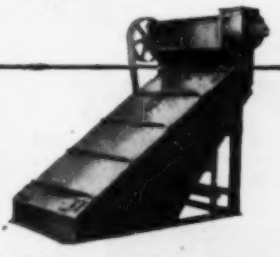


SWING-SLEDGE MILLS for coarse and medium reduction (1" to 20 mesh.) Open door accessibility. Soft, moderately hard, tough or fibrous substances. Built in several types and many sizes.

ROTARY FINE CRUSHERS for intermediate and fine reduction. (1" to ¼"). Open door accessibility. Soft or moderately hard materials. Efficient granulators. Excellent preliminary Crushers preceding Pulverizers. Many sizes.

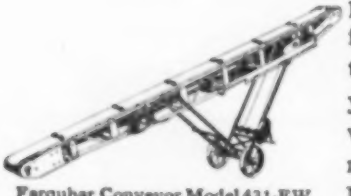


RING ROLL MILLS for medium and fine reduction (10 to 200 mesh) hard or soft materials. Operate in closed circuit with Screen or Air Separator. Open door accessibility. No scrapers, plows, or shields.



MOTO-VIBRO SCREENS screen anything screenable. Classified vibrations. Unit construction—any capacity. Open door accessibility. Open and closed models with or without feeders. Many types and sizes—½" to 60 mesh.

Farquhar Conveyor Model 435-FM with hydraulic lift for fast and accurate freight handling.



Farquhar Conveyor Model 431-EW for heavy-duty handling of bags, boxes, cartons.

FARQUHAR FREIGHT CONVEYORS are designed with one purpose in mind—*to cut handling costs,* no matter what the handling problem may be. Farquhar conveyors are flexible, can be set up quickly, singly or in tandem, to move packaged materials fast, economically, continuously . . . because they're built to "take it." For horizontal conveying, for loading, unloading, stacking, piling or moving bags, bales, boxes, cartons from floor to floor . . . see Farquhar first for the right materials handling conveyor for your job. Tell us your handling problem; we'll see that you get the information you need. Write A. B. Farquhar Company, 219 Duke Street, York, Pennsylvania, or 616-A Elm Street, Chicago 10, Illinois.

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FARM EQUIPMENT
FOOD PROCESSING AND
SPECIAL MACHINERY

Farquhar PORTABLE OR PERMANENT MATERIALS HANDLING CONVEYORS

three. The proportions of the various types of glycerides are probably constant, and the fat splitting occurs in a step-wise fashion as follows:

The original glyceride, containing three molecules of fatty acids, splits off one, then a second, and finally the third and last fatty acid. After the glycerine molecule is completely free of fatty acid molecules, it continues to influence the amount of residual unsplit fat until it is removed from the system.

V. Mills and H. K. McClain, Procter & Gamble Co., before Cleveland Regional Meeting, American Institute of Chemical Engineers, Cleveland, May 12, 1948.

Agricultural Diluents

USE of non-metallic diluents in fertilizers represents an expanding field. Materials of the dolomite type are used to correct excessive acidity in acid-forming fertilizers. Diatomaceous earth and certain clays coat particles of ammonium sulphate and nitrate during the drying process, preventing crystals from agglutinating or setting and keeping them free flowing.

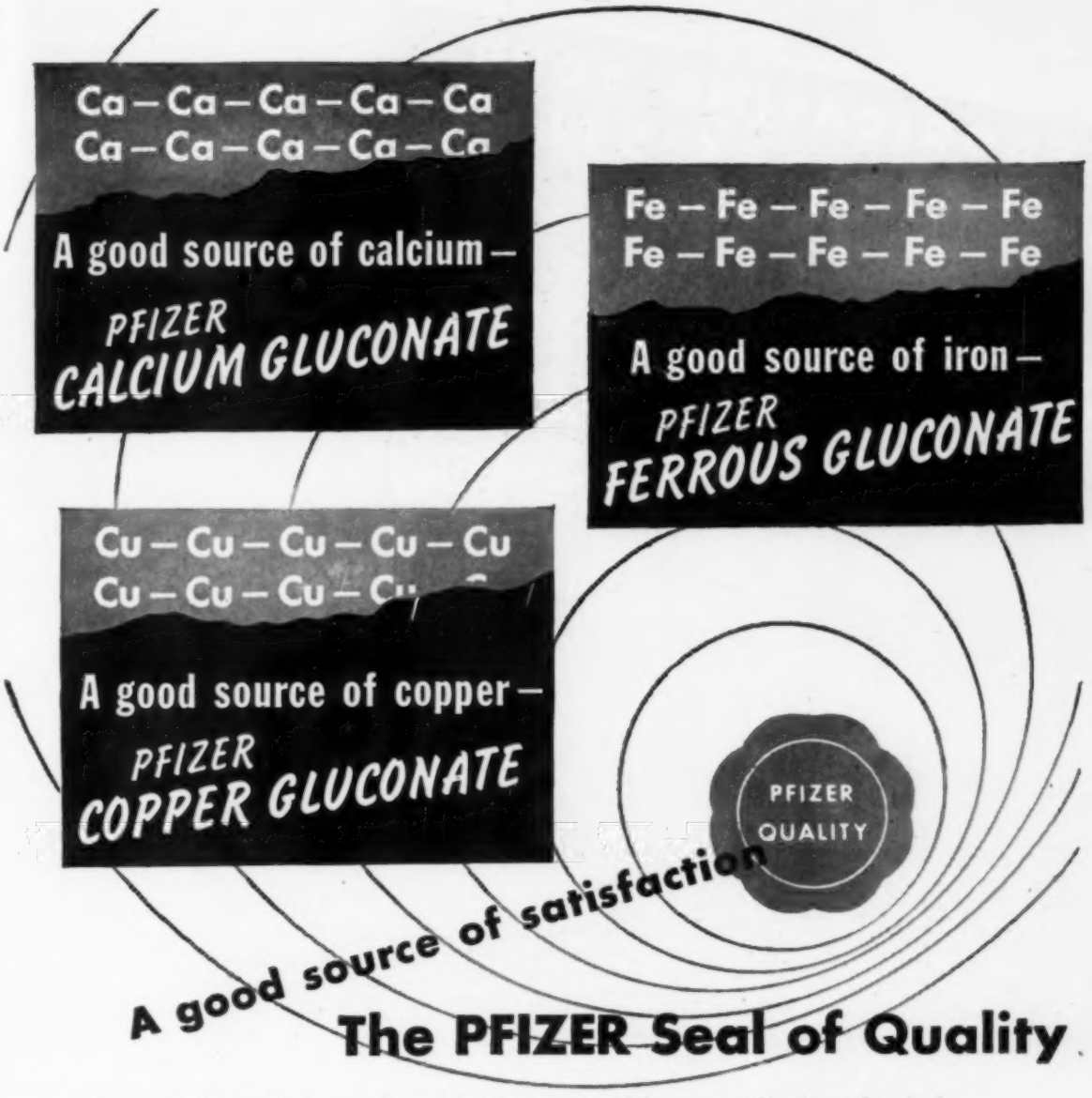
Agricultural diluents are usually spoken of as inerts, meaning they have no toxic effects. While this is true in many cases, there are a number which, if used under certain conditions, have a definite insecticidal effect. They may add to, or detract from, or even nullify the end results sought. As it stands today there is little or no checking to determine true value.

In dealing with agricultural chemicals, we have definite chemical compounds. Study of agricultural diluents reveals a wide variation in mineral composition, impurities and in type of particles. It is necessary, therefore, that each deposit be tested and retested to determine its true agricultural value.

There are many factors which determine effectiveness. A dusty environment itself is unfavorable to many species of insects. Various researchers found correlations between lethal effect and hardness, adhesiveness, fineness, amount used and moisture content of the diluent. In some cases the inert dust may even clog the digestive systems of insects.

Abrasive quality of diluents might be the determining factor in the penetration of toxicant insecticides through the body wall of an insect. The effect of a diluent on the toxicity of a dust mixture may arise from two factors following abrasion: desiccation and increased penetration. Relative importance of diluents probably depends upon temperature and relative humidity.

When blown through a dust appli-


Ca – Ca – Ca – Ca – Ca
Ca – Ca – Ca – Ca – Ca
A good source of calcium –
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CALCIUM GLUCONATE
Fe – Fe – Fe – Fe – Fe
Fe – Fe – Fe – Fe – Fe
A good source of iron –
PFIZER
FERROUS GLUCONATE
Cu – Cu – Cu – Cu – Cu
Cu – Cu – Cu –
A good source of copper –
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QUALITY
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Users of Pfizer Gluconates know the importance of *known quality* in a chemical. They realize that, in its operations, Chas. Pfizer & Co., Inc. combines the soundness of a long-established firm with the progressiveness of a constantly pioneering spirit.

From the company's biological research laboratories, for example, came the production of gluconic acid by a fermentative oxidation of glucose. And each of the salts of this acid reflect, in turn, benefits from the proper selection and control of manufacturing methods and procedures.

Other Pfizer Gluconates which may be of interest include Sodium Gluconate, Magnesium Gluconate, Manganese Gluconate, Acid Gluconic Technical, and Glucono-delta-Lactone. For further details on the present usefulness and potentials of Pfizer Gluconates, please address Chas. Pfizer & Co., Inc., 81 Maiden Lane, New York 7, N. Y.; 211 E. North Water St., Chicago 11, Ill.; 605 Third Street, San Francisco 7, California.

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cator, all diluents receive electrostatic charges. Application tests of dusts showed that when particles held a high plus charge, distribution and effective covering on the plant were more complete.

Particle size and weight or density have a direct bearing on distribution and deposit of a diluent dust. When the diluent particles are extremely fine, one micron or less, they may coat insecticide particles and prevent the latter from coming in direct contact with insects. Failure to control insects with dusts is due to light deposits and poor adherence.

Certain agricultural diluents directly affect the toxicity of the active pesticide chemical. Clay diluents are not compatible with rotenone. The pH of agricultural diluents is important. Alkaline agricultural diluents cause deterioration and are not recommended for use with the new organic phosphates.

Roy E. Miller, Miller Products Co., before Northwest Industrial Minerals Conference. American Institute of Mining & Metallurgical Engineers, Portland, Ore., May 8, 1948.

Cost of Heavy Fuel Oil From Coal Hydrogenation

THE CURRENT short supply of heavy fuel oil from petroleum refining has stimulated a search for supplementary sources of supply. Bituminous and subbituminous coal can be easily converted into an oil which may be readily burned in existing equipment. The Bureau of Mines, Office of Synthetic Liquid Fuels, has made a study of the possible methods, and has selected two for comparative purposes: direct hydrogenation and a combination of hydrogenation and extraction. The make-up hydrogen is produced either by gasification of coal or by low temperature separation from coke-oven gas.

In the direct hydrogenation method, pulverized coal is liquefied in the presence of an excess of hydrogen at approximately 900 deg. F. and 700 atm. pressure. The products of the reaction are distilled in conventional equipment to remove the low boiling components in order to make a finished product.

The hydrogenation step in the combination process is essentially the same as in direct hydrogenation. The principal difference is that the main product is a middle oil having a 635 deg. F. E.B.P., which is used as the solvent in the extraction step. Pulverized coal and solvent are heated to about 800 deg. F. under a pressure of 150 atm. for 1 to 1.5 hr. The extract is filtered to remove the solids and undissolved coal. The low boiling components

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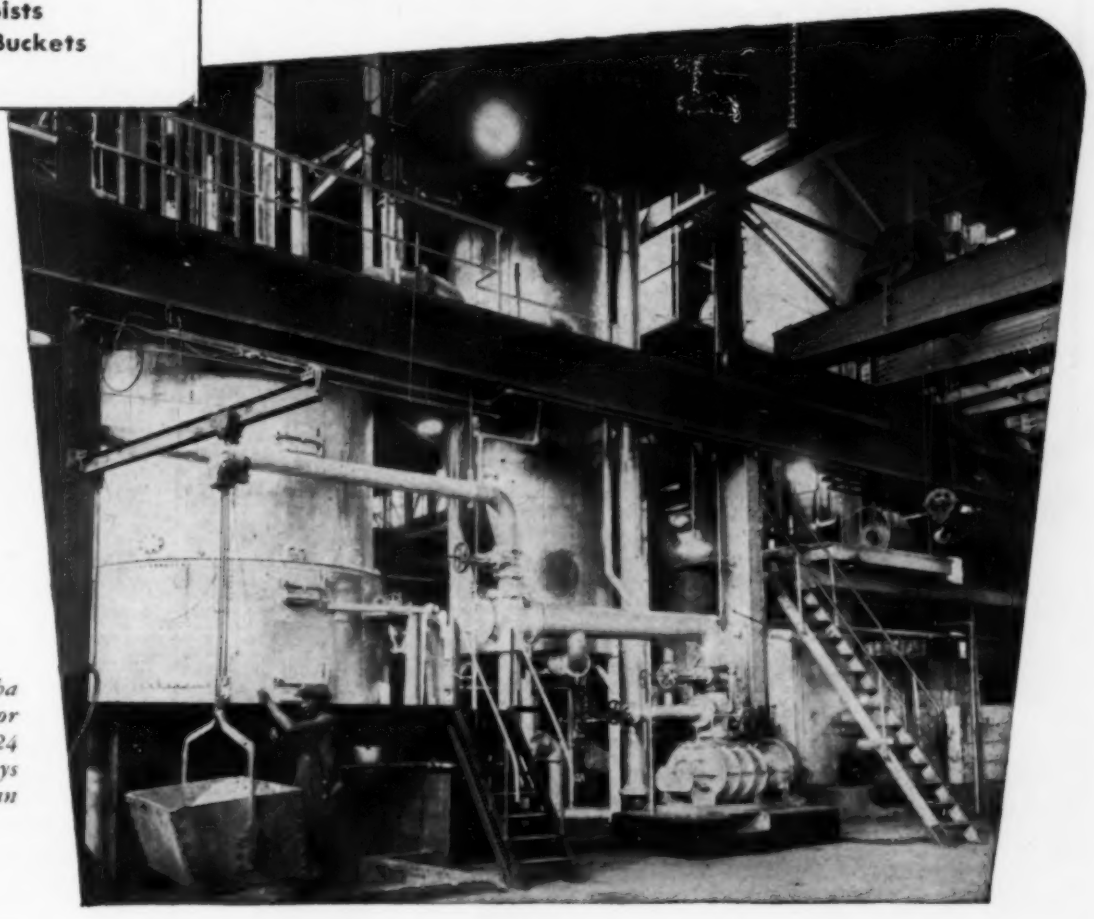

This Wellman-Galusha Clean Gas Generator has been operating 24 hours a day, seven days a week, for more than 17 years.

• The Wellman-Galusha Clean Gas Generator will serve your purpose best because it is a fully water-jacketed gas generator that incorporates, in the machine itself, rotary grates, ample fuel storage bins, and full provisions for the generation of steam required for gas making.

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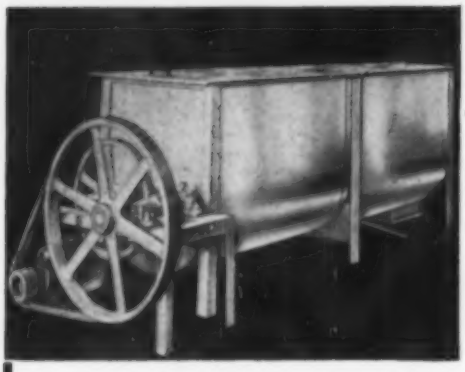

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The entire mixer is made of steel and can be built of stainless steel if required.

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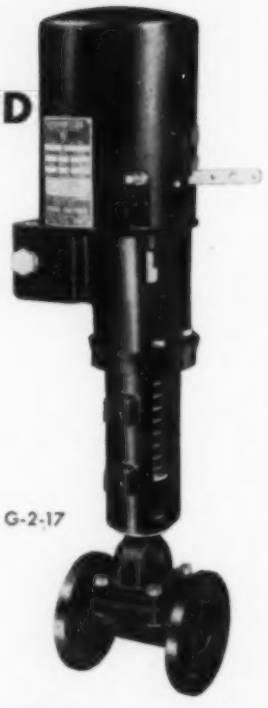

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GENERAL CONTROLS G-2-17 and G-3-17 valves for the remote control of chemical solutions, acids and pulpy liquids where a slow opening automatic valve is required.

Hydramotor operator has no gears, direct-connected motor-driven pump develops *hydraulic* pressure for direct action against an alloy spring loaded valve stem and seating diaphragm.

The entire hydramotor operator is *sealed in oil for life* to assure constant lubrication, reduction of wear, freedom from dust, grit, and other foreign matter thus insuring trouble-free operation and reduced maintenance costs. Valves have simplified two-wire control circuits, automatically go to closed position on current failure.

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FACTORY BRANCHES: — Birmingham (3), Boston (16), Chicago (5), Cleveland (15), Dallas (2), Denver (10), Detroit (8), Glendale (1), Houston (2), Kansas City (2), New York (17), Philadelphia (40), Pittsburgh (22), San Francisco (7), Seattle (1), Oklahoma City (1).
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and part of the solvent are separated by distillation.

Gasoline, liquefied petroleum gases, and phenols are obtained as byproducts in both processes.

The capital investment for a plant to produce 10,000 bbl. per day by each process has been estimated, with hydrogen obtained by (a) coal gasification and (b) by separation from coke-oven gas.

Estimated material quantities and operating costs have been computed. They indicate that the cost of producing a fuel oil suitable for industrial use from coal is not much more than the prices paid for petroleum residual fuel oils during the past year. Such plants will be economically practical in the near future if the present trend of prices for petroleum residual fuel oils continues.

L. C. Skinner, et al., U. S. Bureau of Mines, before Division of Gas and Fuel Chemistry, American Chemical Society, Sept. 7, 1948.

Experiment Stations And Research

THE RELATIONSHIP between the engineering experiment station and graduate research has not been fully explored. In the past, graduate students have depended on teaching assistantships for support and in some instances on fellowships established by private industry. These fellowships are not numerous enough today. The engineering experiment station can help meet educational needs and at the same time fit its educational work to coincide with the program and objectives of the station.

An engineering experiment station may be considered a means by which the engineering college can achieve some of these objectives beyond the teaching of undergraduate courses. As an integral part of the university the station has as its prime functions the conduct of research on natural resources of the area, development of new industries for the area and the rendering of assistance to existing industries. By proper integration the staff assignments may be so arranged that members mainly interested in research will spend most of their time in research and those primarily interested in teaching will devote most of their efforts in that field. The two objectives of undergraduate teaching and research can be brought together as an integrated whole.

As an instance of the role which the Florida Engineering and Industrial Experiment Station is playing in graduate research, the station has a project called "Solar Energy." An early objective of the project was to improve the "hotbox" type of solar heater used

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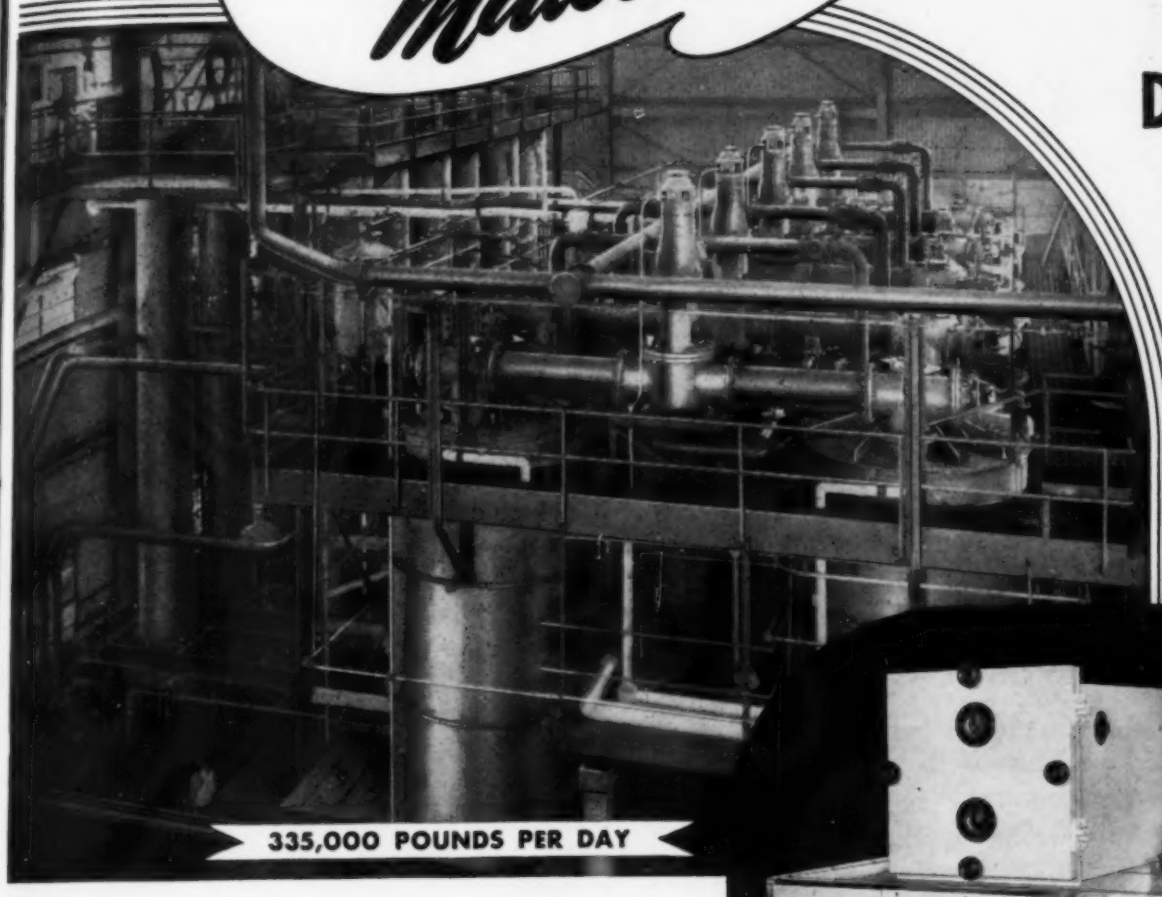

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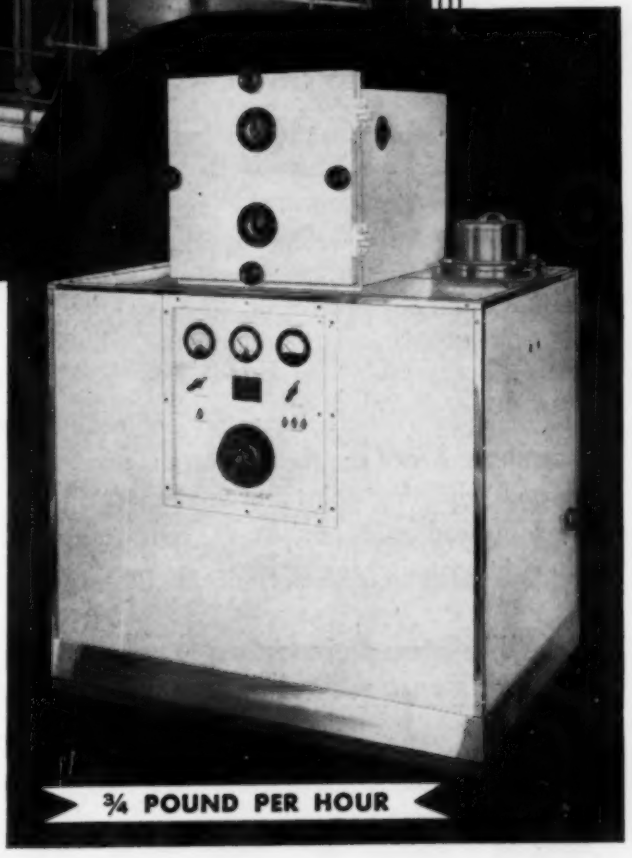

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A preliminary discussion of your problem will entail no obligation and may save you considerable time and expense. Please write the Vacuum Engineering Division of National Research Corporation, Boston, Massachusetts.

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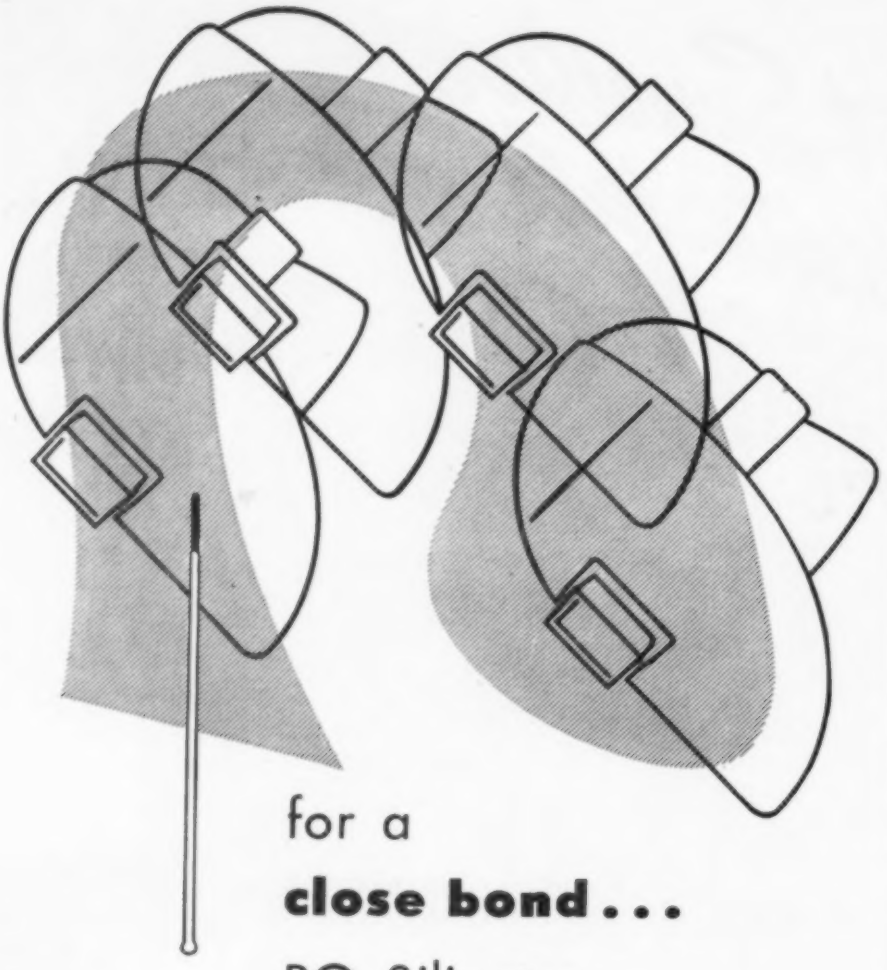

for a
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PQ Silicates

As you watch the welder's sparks fly, discover another use for PQ Silicates. Rod coatings are bound to the metal core with PQ Silicate of Soda (some manufacturers specify PQ Potassium Silicate).

As many as 35 ingredients may be used in coating formulae; hence the right silicate is important to insure the proper softening point and fluxing action. Leading welding rod producers use PQ Silicates for bonding properties in either the dipping or extrusion process.

Philadelphia Quartz Co., 1129 Public Ledger Bldg., Phila. 6, Pa.

This is just one example of PQ Silicate's bonding usefulness. Others include acid-proof and refractory cements, paperboard adhesive, veneer glues, etc. Whenever you need a close bond, look into the economical, all-mineral efficient PQ Silicates.

PQ SILICATES OF SODA

in southern Florida. In the course of the work it was conceived that solar energy might be used for the development of room coolers through the use of the absorption-type refrigeration cycle. A library research indicated that the system lithium bromide-methanol might be satisfactory for such a cycle.

The fundamental thermodynamic data for that system were not available. Here, then, was an opportunity for a graduate thesis which could be sponsored by the station in line with one of its established projects and could be directed by the staff member in charge of the solar energy program. The advantages to the student are obvious. He learns techniques of research. In addition he is doing the work under a staff member who is primarily interested in the broader general problem, a circumstance which gives the student the feeling of contributing to a larger program at the same time he is gaining the fundamental information. The problem culminated in a master's thesis which will be published shortly.

R. A. Morgen, University of Florida, before American Society for Engineering Education, Austin, Tex., June 14-18, 1948

Process Trends in the Chemical Industry

IT SEEMS that the over-all outstanding process trend in the chemical industry is the turning to petroleum as a raw material for an increasing number of chemicals. Other important trends seem to be the resumption of longer range planning for individual branches of the chemical industry now that the war has passed. This involves not only raw materials but processes and markets. As an integral part of this, the change from batch to continuous processing seems to be on the increase. Many concerns are reestablishing their peacetime research projects not only to improve present processes but to enlarge their line of manufacture. In the chemical field now, most concerns spend from 2 to 3 percent of sales on research with a high of 5 percent for certain specialized fields and companies. The chemical industry is still short of certain raw materials, for example, benzene and naphthalene. The latter is in a particularly critical situation without any expectation of the resumption of prewar importations. Some investigation and much discussion are being directed toward utilization of farm raw materials. There is no question but that employment of products that can be grown on the soil, renewed from year to year, will increase as the decades go along. Finally, among the major tendencies in the process field is the continuation and enlargement

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Further, No. 225P is the TOUGHEST bronze valve your money can buy. The stainless steel, noncorrosive seats and discs are heat treated to a hardness of 500 Brinell – hard enough to scratch glass and crush nails. For this reason, the valve can be closed on sand, slag, scale and similar flotage without injury to the seating surfaces, and "wire drawing" is practically eliminated. Thus years of tight, positive shut-off are assured.

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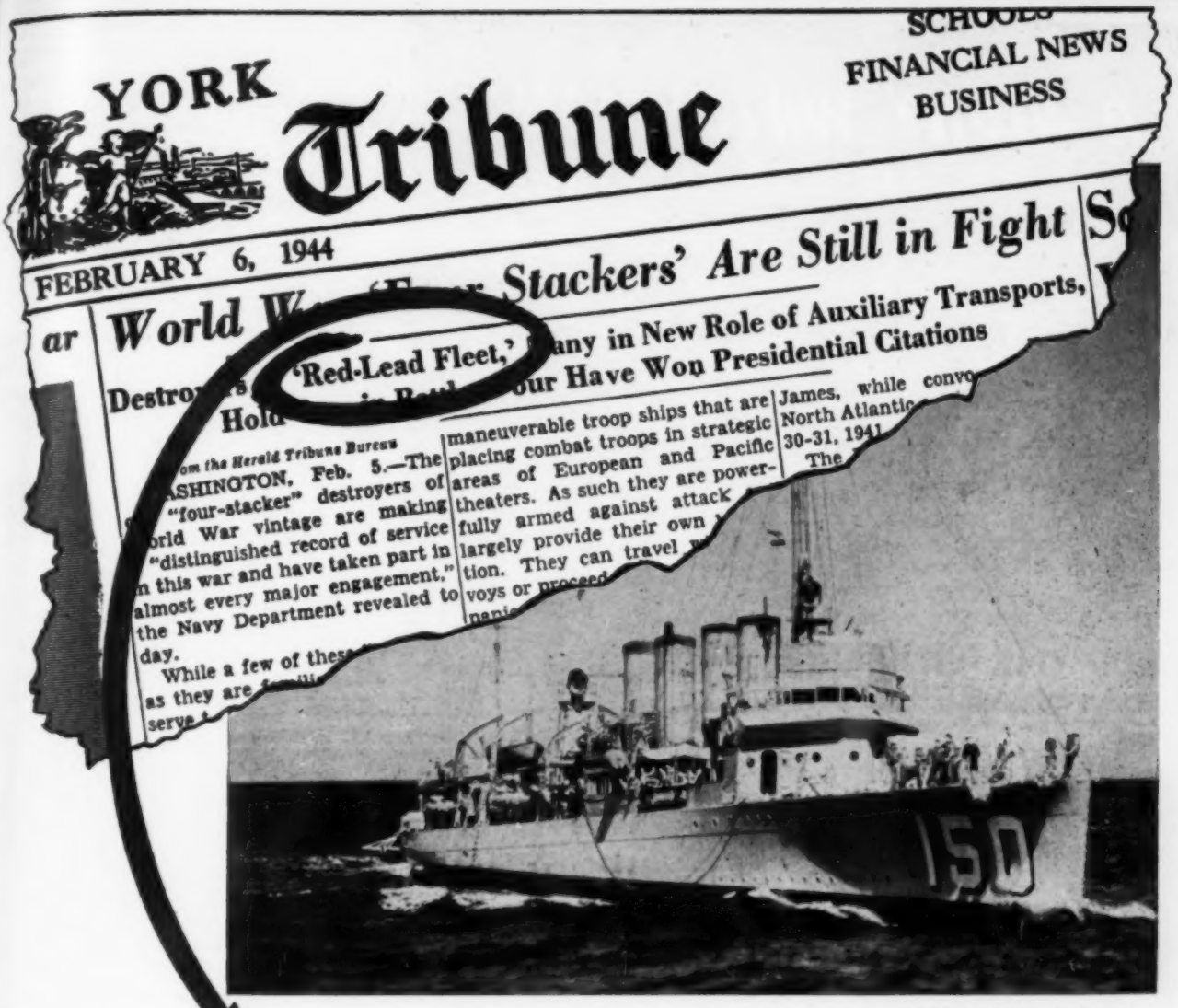
of plant expansion, much of which was held in abeyance during the shortages caused by the war in material and personnel. This expansion for some of the private concerns in the chemical field ranges from 10 to 46 percent of 1946 plant facilities.

R. N. Shreve, Purdue University, before American Institute of Chemical Engineers, Chicago, March 23, 1948.

Find Out Why

THE forces which have produced the outstanding advances of the last 25 years in the paint and varnish business are the result of the application of simple scientific principles by hundreds of trained and conscientious technical men throughout the industry. The principles are so simple that we sometimes fail to realize that they have formed the basis of all scientific endeavor since the days of the ancient Greeks. The constant determination to find out Why; the conviction that every occurrence has a natural and understandable cause and that by finding that cause we can make the occurrence happen or prevent its happening at will; a deep respect for facts and the patience and industry to establish facts by experimentation and observation; the unwillingness to accept or to state a thing as fact unless it is supported by sound evidence; the insistence on finding all the facts, not being willing to accept the first result that gives temporary satisfaction but the determination to systematically explore all the possibilities until the best solution has been found; the willingness to change one's opinion as new facts and new information become available; and, above all, that broadness of mind and that constant reaching for all the information and all the possibilities which can be gleaned from the whole field of science for the solution of the particular problem at hand. These principles identify the true scientist

The men who have applied these fundamental scientific principles to the advance of the paint industry have been pioneers in what I choose to call a new science—the science of solving practical problems by scientific means. Faced with problems which they could not solve by applying the established practices of the traditional sciences, they have gone back to the basic fundamentals of scientific thinking, itself, and in applying these principles to the needs of a practical industry they have built a body of the organized knowledge specifically suited to their own needs. They have not hesitated to borrow freely from the traditional sciences. From chemistry they have taken the conception of considering the properties of materials in



Official U. S. Navy Photograph

"Red Lead"—the pigment that for almost 20 years protected the bottoms of hundreds of World War I destroyers as they lay at anchor. Painted with red lead to prevent corrosion, these veterans of the last war were available for active duty when they were most needed and have made a "distinguished record of service in this war."

The superior rust inhibitive qualities of pure red lead and linseed oil as a protective coat for steel has been recognized for generations. Additional evidence was furnished during World War II when millions of tons of cargo were transported by the Merchant Marine in hulls protected by red lead.

Nevertheless, to definitely establish red lead as the best marine primer, an extensive research program was initiated by the Red Lead Technical Committee of the Lead Industries Association. At various testing grounds in different climates over two hundred formulations and controls have been studied as to their performance in both marine and industrial atmospheres. The marine tests were conducted both at half tide and in total immersion. The results of these long range tests may be summarized as follows:

Multiple pigment primer paints based on red lead have been formulated which are superior in performance characteristics to other primers. Additional advantages are freedom from blistering plus ease of manufacture, satisfactory package stability and the ability of red lead multiple pigment primers to meet a repainting schedule of four hours.

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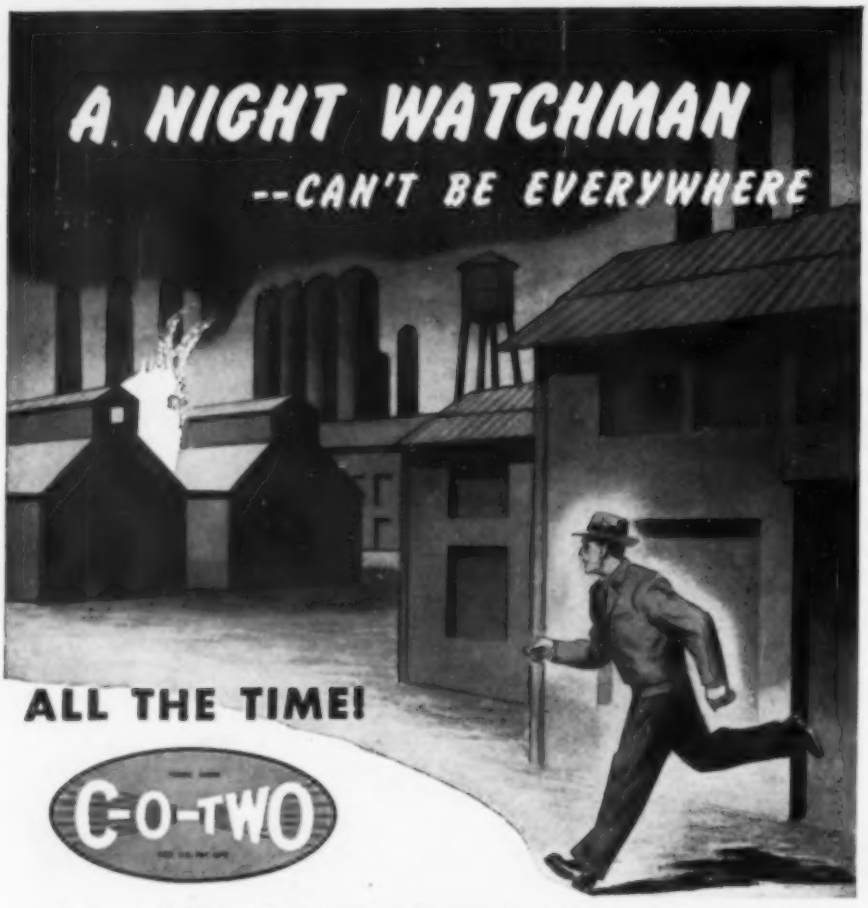

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terms of their composition. From physics they have taken the respect for accurate measurements of properties, and from mathematics they have taken the principles of analysis of data. All this they have used as expediency dictated, ofttimes without consciously realizing that their training was leading them in the use of scientific methods, even when they, themselves, may have often felt they were only using common sense.

C. F. Rassweiler, Johns-Manville Corp., before Division of Paint, Varnish and Plastics Chemistry, American Chemical Society, Chicago, April 22, 1948.

New Commercial Chemical

DIGLYCOLIC acid is available now for the first time on a commercial scale. As an oxygen-linked dibasic acid it provides industry with a new raw material of many potentialities.

Diglycolic acid is a white, odorless, relatively nonhygroscopic, crystalline product which can be packaged and used as a solid. It is intermediate in strength between acetic acid and oxalic acid. Over a wide range of conditions it shows good chemical stability. It can be esterified by direct methods or by alcohol exchange. The anhydride, acid chloride, amide, salts, and many other derivatives can be prepared by familiar techniques. Of these derivatives the esters appear to be most interesting, and some are expected to help fill the present need for more plasticizers. Some toxic effects of the methyl and ethyl ester have been observed, but experience has shown that both these materials are safe to handle if proper precautions are exercised.

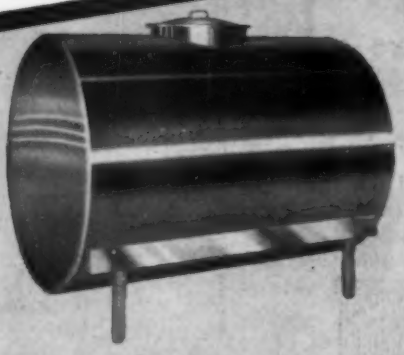
Walter M. Bruner, E. I. du Pont de Nemours & Co., before Division of Industrial and Engineering Chemistry, American Chemical Society, St. Louis, Sept. 8, 1948.

Lower the High Break-Even

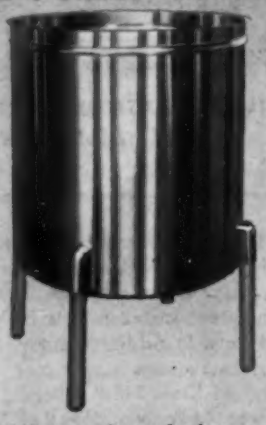
PERHAPS one of the most disturbing factors facing the business man today is the relatively high break-even point he encounters. It is easy to complacently disregard a high break-even point when profits are high, but every progressive management today is looking ahead to possible lower sales volume, and carefully analyzing the company operations to see what can be done to lower the high break-even point.

It is disheartening, to say the least, when one reviews comparative statements of today and a few years ago. In most cases the sales and profits figures are up, to be sure, but the unit cost figures are also up and, unfortunately, the break-even point has gone perilously high. A further rise in costs, a reduced sales volume, or

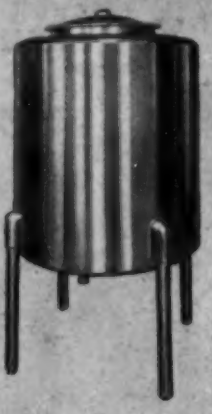
All the Requirements FOR LIQUID PROCESSING



TYPE "H." A mixing or storage tank recommended for low headroom installations.

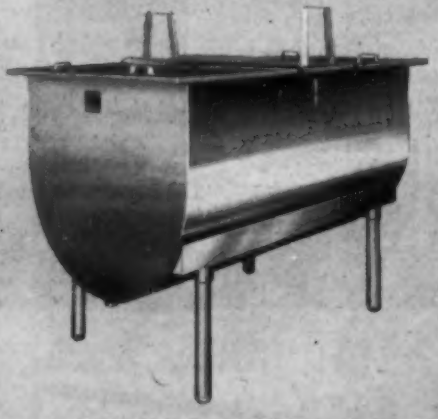


TYPE "J." A modern design open-top San-I-Tank.



TYPE "K." Closed top tank for mixing or storage.

TYPE "L." Large capacity and low sides for shoulder height operation.



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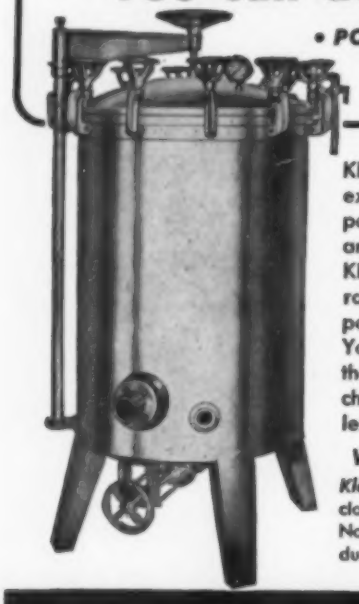

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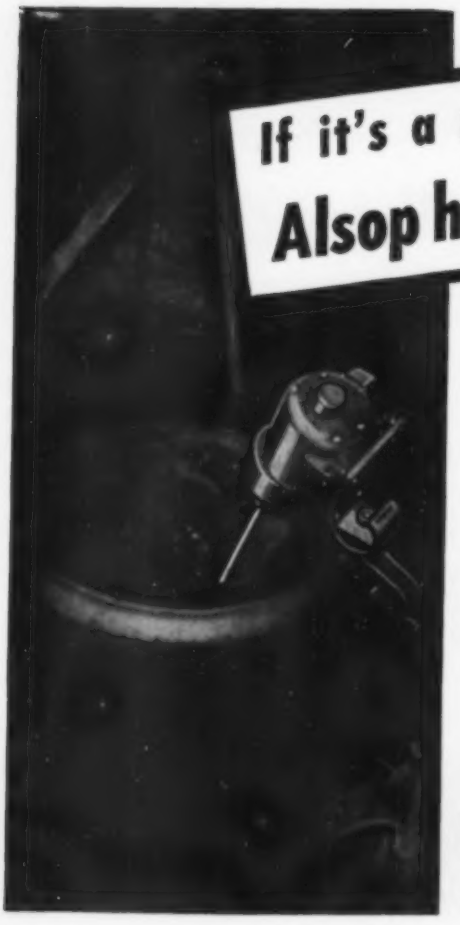

If it's a mixing problem, Alsop has the answer

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lower selling prices might be very serious. That is why management today is considering this problem in an attempt to lower the present high break-even point.

The accounting department will prove invaluable in gathering statistics, interpreting figures, and conducting studies in order to present management facts on which to base any changes.

Look at cost of raw materials; are you getting the best price? Perhaps larger quantities would mean smaller unit price; perhaps smaller quantities would release expensive space used for storage. Consider substitution of a cheaper raw material. Consider material losses on rejects.

Are you getting the most out of each worker-hour? Consider incentive systems, or improvement of the one you have. Review plant layout; the worker needs adequate facilities and space. Faster and more efficient equipment will lower unit labor cost.

Analyze reports; eliminate where possible. Expensive and possibly unnecessary procedures can go, too.

Effective safety programs lead to lowered workmen's compensation rates. Review of insurance programs may disclose possibilities for reduced premiums, with better protection for less money.

Look at selling, general and administrative expenses. Re-examine the product research program. Consider diversifying lines.

E. J. Johnson, CPA, before the Society of the Plastics Industry, Atlantic City, May 20-21, 1948.

D. C. Prophecy

THE CHEMICAL industry, which includes not only the light metals such as aluminum and magnesium but the special chemicals such as chlorine and caustic, is a very large user of electrical power. A large proportion of the energy used is d.c., which requires conversion equipment. The advantages of electric power over other forms of power have long been recognized in this industry, and it is now highly electrified. With new chemicals developed during the war just going into production, the industry is due for a large expansion. With industrial concerns eating up chemicals at a tremendous rate, the industry has not been able to keep up with the demand, and there has been shortages in some chemicals far more serious than the shortage of steel has been. This has not been caused by a shortage of electric power, but rather by a shortage of critical materials from which the chemicals are manufactured. The industry has an installed

Try an Amsco solvent for that *"impossible"* job

In many a plant today an Amsco solvent is being used to solve problems, that, at first, seemed almost impossible.

One reason for this is that our petroleum-base solvents are so extremely flexible and versatile. Add to this flexibility Amsco's quarter century of seasoned experience, and you can see why we welcome the chance to tackle knotty problems.

Amsco solvents are dependable . . . efficient . . . economical. They cost no more than less time-tested materials and you get:

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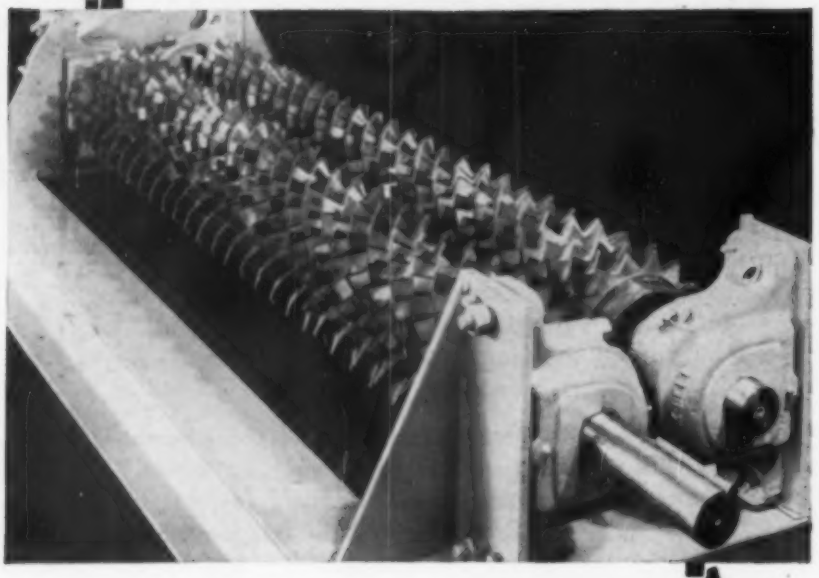
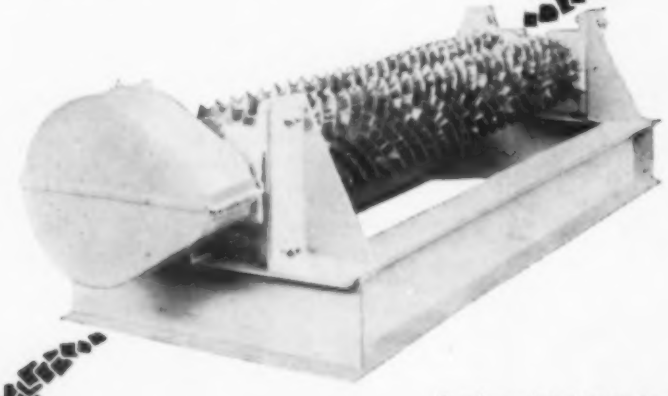


TO streamline mastic floor tile production by reclaiming scrap—that's the job this special 62" Saw-Tooth Crusher was designed to do.

Installed at the end of the production line, it breaks up the selvage as well as the rejects . . . for reprocessing. It assures uninterrupted production on a continuous ribbon of stock 60" wide.

S-W Saw-Tooth Crushers are outstanding for preliminary stock reduction in sheet, slab, or cake form — where high capacity, low power, and minimum fines are important.



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SPROUT WALDRON
Manufacturing Engineers
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Stock reclaiming is just another field in which the "ADAPTION-EERED" approach proves successful. For resultful recommendations on your processing operations, contact Sprout, Waldron & Company, Muncy, Pa.

capacity in rectifiers of over 200,000 kw., and this is increasing daily.

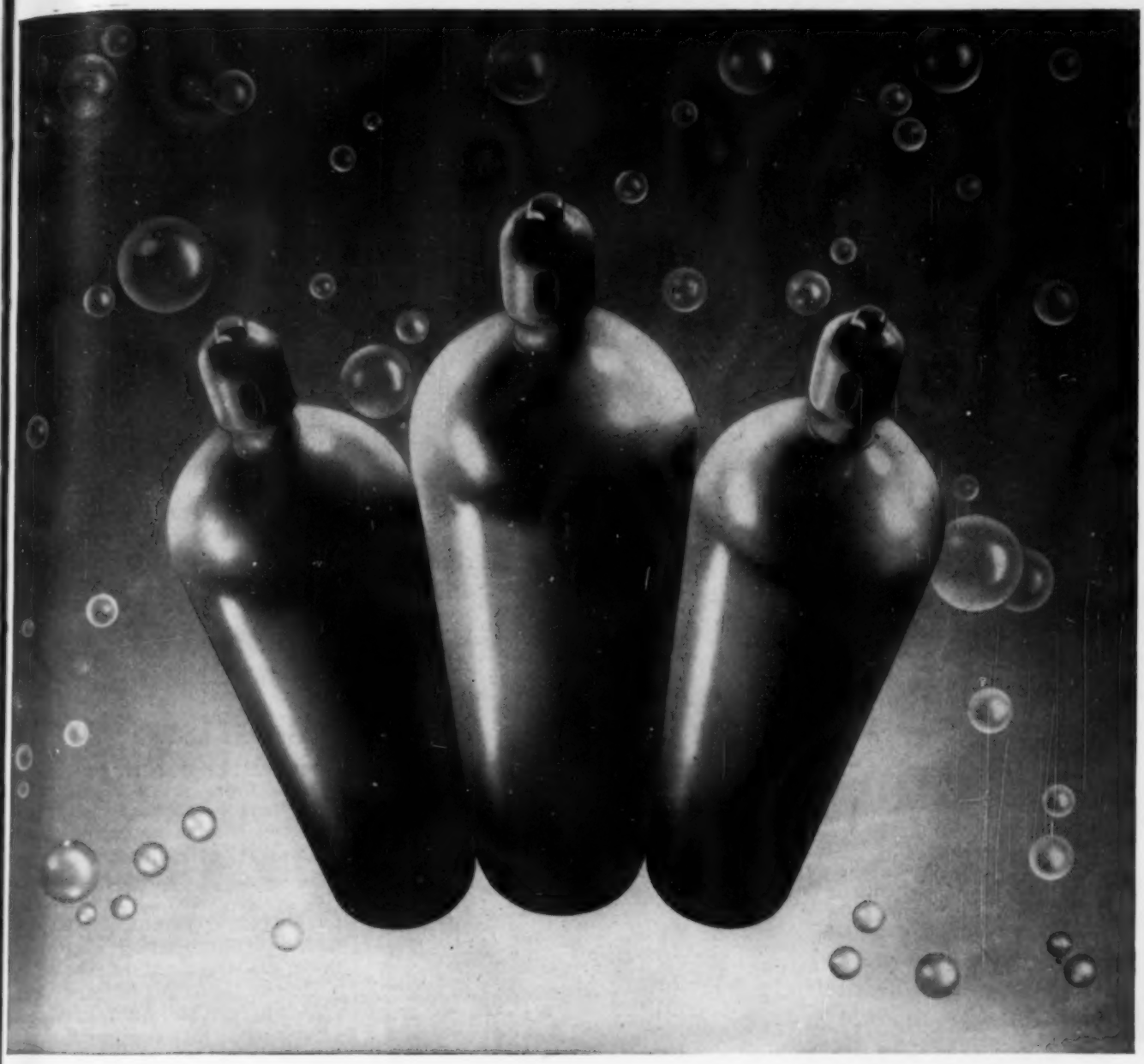
The development of the aluminum industry during the war was quite comparable to any of the Seven Wonders of the World, not only in the speed with which it was accomplished but also in the amount of rectifiers absorbed by the industry. At the end of hostilities it was expected that we would have more capacity in aluminum and magnesium than the country could conceivably require. At first production slumped off rapidly due to the closing of many of the high-producing aircraft plants, but the steel shortage was instrumental in bringing out the advantages of aluminum for many types of products. Now the aluminum industry is nearly up to the capacity at which it operated during the war. We expect this industry to continue at high capacity for some time; then, as aluminum finds its real place, there will be a gradual increase in production which will require large additional amounts of power. There is installed today in the aluminum industry about 1,500,000 kw. of rectifiers alone, and this could very conceivably double within the next 10 years. As this type of load is normally on a 24-hr. basis, an equal amount of generation capacity would be required.

Magnesium, which was first developed on a commercial basis using the sea water process, has been slow to take hold in industry. It was very widely used in castings and in sheet form during the war, but it has not gained its expected popularity in the postwar picture. However, industrial designers are beginning to realize that they are failing to take advantage of one of the most versatile new metals available to them. We shall see a complete reversal in the use of this material within the next 10 years. At the present time there is only one source of supply, and it is adequate for present needs. However, this industry has an installed capacity of about 400,000 kw. It is not at all inconceivable that the industry will double its power consumption within 10 years.

F. R. Benedict, Westinghouse Electric Corp., before Midwest Power Conference, Chicago, April 7, 1948.

Pitfalls of Chemical Market Surveying

SURVEYING chemical markets necessarily involves dealing with statistical data. Unfortunately, many persons assigned to such activities have not had formal training in statistics. The recitation of various workaday experiences with market statistics may serve to alert chemists in this field to some of its more embarrassing pitfalls. Sta-



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FOOD PRODUCTS
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- Malt-Rice
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MINERALS
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CUT handling costs, time and wasted manpower by installing Beaumont Birch Bulk Materials Handling Equipment. A Beaumont air conveyor will move your materials up, down or in any direction through a pipe. Fast and dustless, it conveys chemicals and ores from the time they arrive by rail to their use in various processes.

Sizes and capacities depend upon the job and the material. Under usual conditions a 4-inch conveying pipe will move 5 tons of material per hour. The systems—either pressure, suction, or combination, as shown—are available for capacities from 1 to 100 tons per hour.

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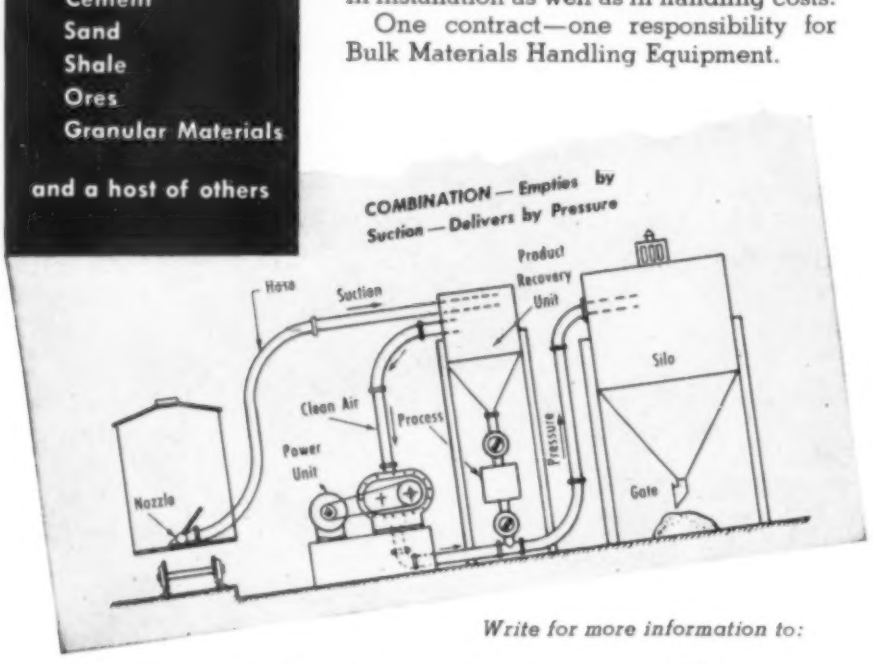

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tion flux distribution, and a group of simultaneous mechanisms tied up with the transfer of energy. Preparation for such issues requires an excellent command of mathematics, knowledge of the interaction of radiation with matter, and an understanding of the laws of diffusion.

The problem of a graduate program for chemical engineers interested in nuclear technology is: (1) what should the universities do, and (2) how can the student enter the field. It is not desirable that the schools convert their graduate facilities to turn out "nucleonic engineers."

For chemical engineers there is a normal leeway in subject matter on the graduate level, and the preparation for further nucleonic work should be a good program for any other serious technical field. Fluid dynamics, heat transfer, diffusion, properties of matter and the mathematical basis for these subjects are available almost in all universities. Courses in nuclear technique will do no harm, but should not displace the other subjects mentioned.

The problem of finding a means of inducting a student into the nuclear laboratory is, at present, formidable. There is almost no way to bring research personnel in engineering into research work except through a complex employment system. All elements of this system, including security safeguards, contrive to discourage able candidates; and the number of research engineers in the whole atomic project is small.

To illustrate the problem, newly graduated engineers are employed by usual methods plus a period of investigation. They can attend several lectures per week sponsored by the Laboratory. If they wish to take advanced course work they can do so without penalty through the Oak Ridge Institute for Nuclear Studies provided they lose no working time and take only one course. For students who have passed their preliminary examinations for the doctorate, a few fellowships may be arranged through the Oak Ridge Institute. Such concessions to provide qualified engineers are inadequate.

R. M. Boarts, University of Tennessee, before American Society for Engineering Education, Austin, Tex., June 14-18, 1948.

Making Executives From Engineers

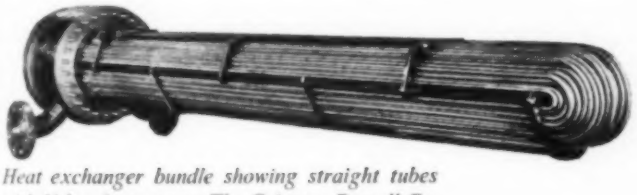
ANY successful business must design a product for which need exists or for which need can be created. It must procure its materials and plan its production so that costs will allow a reasonable profit markup—and still meet or better the price and perform-

Fighting Water-Side Corrosion . . .

WITH BETTER CORROSION-RESISTING COPPER-BASE ALLOYS

Probably the biggest corrosion problem encountered in petroleum refining, petro-chemical and chemical processing, strange as it may seem, concerns the water side rather than the product side of heat transfer equipment. The many millions of gallons of sea water used daily by the average seaboard refinery present the same type of corrosion problems for heat transfer equipment as confront the huge seaboard power stations.

For many years, Admiralty tubing (70% copper, 1% tin, balance zinc) has been a favorite with the petroleum industry and is still giving excellent service with fresh circulating water taken from lakes, rivers and streams, even when polluted with industrial wastes and sewage. However, in some plants using polluted harbor water or brackish waters, Admiralty has not stood up as long as desired. Under such conditions, a change in alloy is recommended. As with power plants, considerable attention is being given by the chemical and petroleum industries to more corrosion-resisting alloys—Aluminum Brass, Duronze IV* (arsenical aluminum bronze), and Cupro Nickel.



Heat exchanger bundle showing straight tubes with U-bends, courtesy The Griscom-Russell Co.

Experience of Seaboard Power Plants—Bridgeport's Arsenical Aluminum Brass (copper 76%, aluminum 2%, balance zinc) is popular with power plant operators for combating impingement corrosion from turbulent sea water. It also resists dezincification and general thinning exceedingly well. A number of seaboard petroleum refineries are having good results with this alloy.

Duronze IV (95% copper, 5% aluminum) stands up better than most other alloys against corrosion from polluted harbor waters, brackish waters and chlorinated sea water. This alloy is now standard for condenser tubing in some large seaboard power plants and is finding increased application in petroleum and chemical plants. Duronze IV also has excellent resistance to impingement corrosion from rapidly flowing sea water. An important industrial application is the conveying of hot brine solutions.

Cupro Nickel (70% copper, 30% nickel) is standard with the U. S. Navy for condenser tubing in battleships. Alloyed with a small percentage of iron, Cupro Nickel has excellent resistance to impingement corrosion from turbulent sea water. In some cases it is replacing Admiralty in petroleum refinery applications. Cupro Nickel is very resistant to season or stress corrosion cracking. It is recommended for use where higher temperatures and the presence of ammonia are detrimental to brass. It also has excellent resistance to sodium hydroxide solutions in the absence of sulphides.

Duplex Tubing—Where a corrosion problem is too severe for a single metal or alloy, Duplex Tubing is performing valuable service. A good example is ammonia refrigeration systems where Duplex Tubing of steel to the ammonia and a copper-base alloy to the water side is very successful. In the chemical processing and pharmaceutical industries Duplex Tubing is used to prevent taste and color contamination on the product side. The use of Duplex Tubing is steadily increasing in petroleum and chemical plants as its possibilities are being explored. It is available in many combinations—Copper, Admiralty, Red Brass, Cupro Nickel, Aluminum Brass, Duronze IV, etc., with steel, stainless, aluminum, monel or nickel either inside or outside.

Which Alloy Is Best? From an economic standpoint—long, uninterrupted service, low maintenance and infrequent replacement the best alloy is the cheapest in the end. Petroleum and chemical engineers are giving much thought to using other alloys besides Admiralty. Since it is difficult to predict which alloy will give the best results under the conditions involved, operators have found it advantageous to tie in with Bridgeport's Corrosion Laboratory service and try out several different alloys under actual operating conditions.

Contact the nearest Bridgeport office for information, and write for your copy of Bridgeport's 120-page Condenser Tube Manual. This contains valuable information about condenser and heat exchanger tube alloys, corrosion data and methods of prolonging tube life.

*U. S. Pat. No. 2093380

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ance of competitors. It must integrate all phases of its effort—design, procurement, manufacture, distribution, sales, finance . . . . over-all management—for maximum efficiency at lowest practical costs.

Top-level executives usually came from two professions—they were bankers or lawyers. Few came from the ranks of engineers because of the dearth of engineers with the broad interest and experience required.

Despite these handicaps, during the last decade engineers have begun crowding the bankers and lawyers in this contest for high-level administrative posts. So successful have been their efforts that an independent survey shows that ¼ of the largest corporations in America—50 out of 150—are headed by graduate engineers. This figure becomes even more significant when one recalls that there are 10 liberal arts and teachers colleges in the country for every engineering school.

Five special attributes appear to mark these successful individuals: (1) An ability to express themselves clearly and well; (2) normal curiosity regarding economics, finance, law, psychology, and other non-engineering subjects; (3) a willingness to make the logical and reasonable compromise with perfection which day-to-day business requires; (4) a ready understanding that income must exceed outlay; and (5) above all, an ability to get along with contemporaries and at least to understand their competitors.

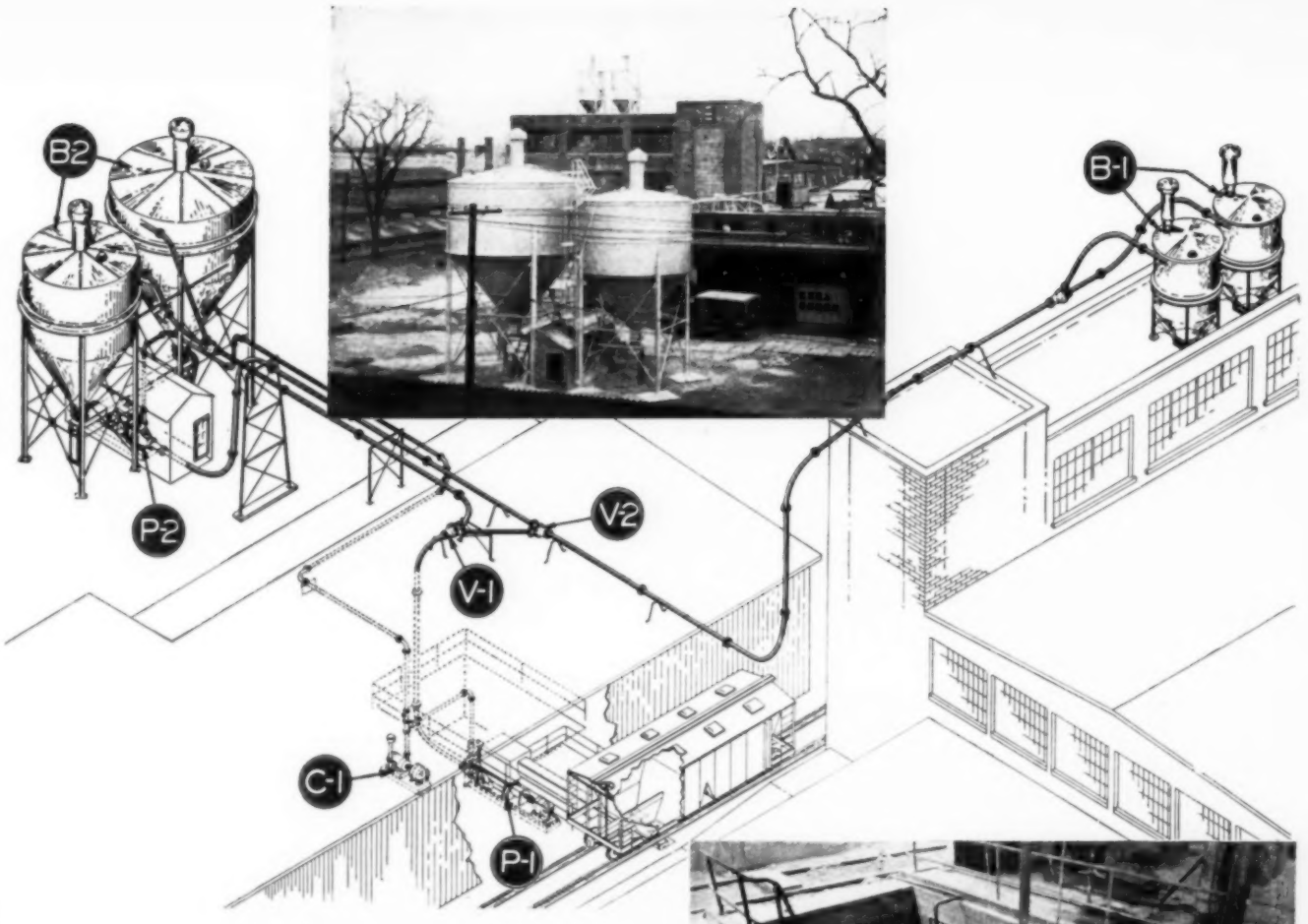
We know that some engineers do make good administrators. The problem seems to be why aren't there more engineers in executive posts, and what can we do about it?

The answer to the why question lies deep-rooted in the personal traits of character necessary for a man to be an engineer; and in turn, in his training, his choice of employment, and in the general environment which these things produce.

An engineer's training—an orderly scientific approach to a given problem—gives the engineer a sound foundation for management responsibilities. If he adds the special attributes mentioned, he becomes eminently qualified for broader responsibilities.

Greatest weakness of the present system, as I see it, is this failure to provide good, solid, academic fare which will guarantee a good engineering education plus the broader business background which will enable graduates to qualify readily for broader horizons.

Industry must not be guilty of limiting the possible achievements of the engineer in the management field. The engineer doing exemplary work in the laboratory or in the develop-



FULLER-KINYON SYSTEMS UNLOADING FROM CARS . . . CONVEYING DIRECT TO PROCESS OR STORAGE . . . RECLAIMING FROM STORAGE AND CONVEYING TO PROCESS

The installation illustrated is used for unloading and conveying Portland cement and filler dust in an asbestos shingle plant. These systems, installed in an existing plant, were designed and built to service process equipment and provide for future expansion.

One system (P-1) unloads materials from hopper bottom cars and conveys, through the use of two-way diverting valves (V-1 and V-2), direct to process bins (B-1) on top of building, or to reserve storage bins (B-2) in the yard. A second system (P-2) conveys materials from the storage bins (B-2) to process bins (B-1). A very flexible and simple system, economically possible only with Fuller-Kinyon.

A Fuller Rotary Single-stage Compressor (C-1) furnishes air for either conveying system, capacity 282 c.f.m., 25-lb. pressure. Air, where and when needed, and at the right pressure to do the work most economically and efficiently.

When your problem is conveying dry pulverized, crushed and granular materials, get in touch with us. Our engineering department is at your service . . . no obligation on your part.

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P-97

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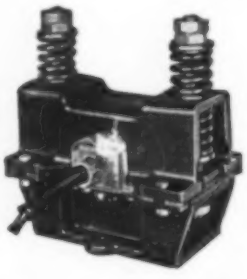

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ment field must not be prejudiced in his opportunities to accept new responsibilities because of the value of his work in his engineering position.

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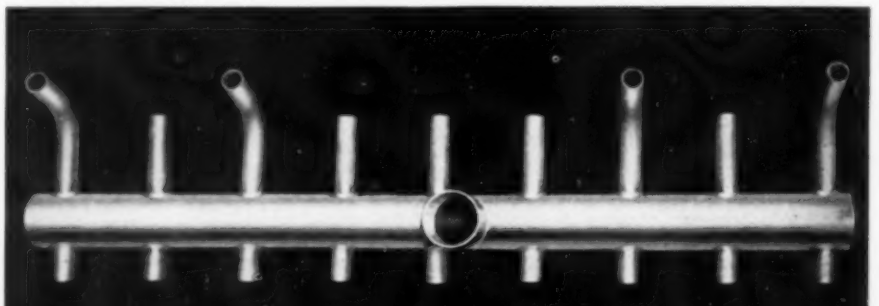
Walter Evans, Westinghouse Electric Corp., before Tau Beta Pi, Johns Hopkins University, Baltimore, April 29, 1948.

FOREIGN LITERATURE ABSTRACTS

Chlorination of Hydrocarbons

NEW catalysts have been proposed and applied in recent years for chlorination of aromatic hydrocarbons. Complicated catalysts consisting of aluminum, copper, iron and cobalt, and of sulphur, antimony trichloride and lead, have been recommended for the chlorination of benzene, as well as some of its derivatives. A good yield of monochlorobenzene is supposed to be obtained by passing benzene hydrogen chloride and oxygen or their mixtures with water vapor, nitrogen and other diluents at 170-200 deg. over a catalyst consisting of a copper salt with the addition of salts of such metals as cobalt, nickel, iron, chromium applied on pumice, silica gel or some similar material. A new development is the use of metal catalysts to introduce chlorine into the aliphatic side chain in benzene homologs. If, for example, chlorine is passed into *i*-propylbenzene at 153-155 deg. in the presence of powdered aluminum, β-monochlor-*i*-propylbenzene is obtained with a good yield. This product has antiseptic, bactericidal and fungicidal properties. The use of organic bases for analogous purposes is another new development. Pyridine or dibenzylamine is recommended for the chlorination of ethylbenzene. Application of certain organic peroxides as catalysts has met with great success in the chlorination of aliphatic side chains in aromatic hydrocarbons. Toluene reacts with chlorine very



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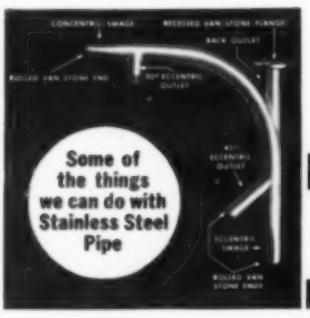

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rapidly (reaction is completely finished within 30 sec.) in the presence of 2 molar percent of ascaridole, forming 58 percent products of substitution in the side chain and 42 percent products of addition in the nucleus. Under these same conditions benzene gives a 100 percent yield of hexachlorocyclohexane.

Digest from "Advances in the Field of Chlorination of Hydrocarbons in the Last 10 Years" by L. S. Solodar and V. V. Markin, *Uspekhi Khimii* XVI, No. 1, 83-109, 1947. (Published in Russia.)

Catalytic Decomposition Of Diethylacetal

DIETHYLACETAL was decomposed by passing its vapors over catalysts which are most active in the acidless etherification of alcohols. Work was also done with Al_2O_3 as a dehydrating catalyst and nickel as a hydrating catalyst. Tests on the heat resistance of diethylacetal showed that there was hardly any decomposition at 350 deg. whereas there is considerable decompostion even at 200 deg. when a catalyst is used. Experiments were conducted in the usual manner by passing a stream of the diethylacetal through a glass tube at a temperature ranging from 200 to 350 deg., the layer of catalyst being an average of 13-16 cm. long, and the rate of passage of the acetal 15 ml. per hr. The catalysts used were pure copper, copper mixed with uranium and zirconium, aluminum oxide, and nickel. On being passed over the catalyst the vapors decomposed with formation of variable quantities of ethanol, ethanal, ethyl acetate, vinyl ethyl and ethyl ethers, acetic acid, water, ethylene, hydrogen, carbon monoxide and dioxide, and saturated hydrocarbons. Ethanol and vinylethyl ether (from which ethylene and acetaldehyde formed) were formed with all the above catalysts. Specific action of one or another catalyst was shown chiefly in their different effects on the further conversion of the ethanol and acetaldehyde.

Digest from "Catalytic Decomposition of Diethylacetal" by U. N. Berg and M. N. Vishnyakov, *Zhurnal Obshchei Khimii* XVII, No. 9, 1618-1625, 1947. (Published in Russia.)

Synthetic Fat Production In Germany

PREPARATION of synthetic fat products is of particular importance to Germany now in view of the shortage of oils and fats for food as well as technical purposes, and the difficulties of importation. In 1936 Germany used 2.2 million tons of natural fat for food and technical pur-

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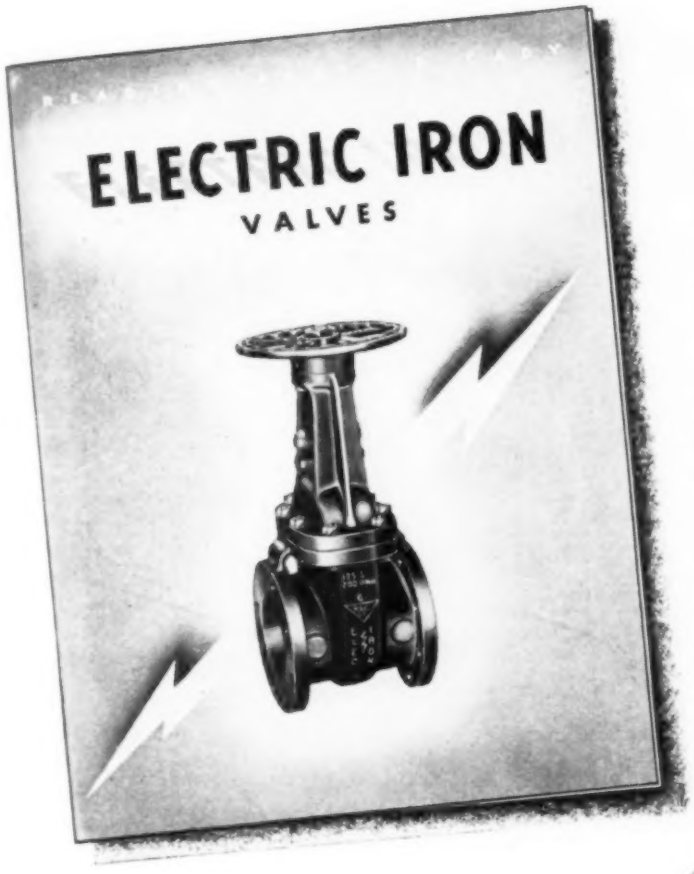

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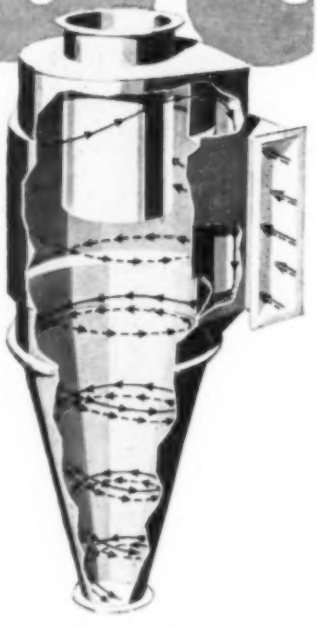

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poses, some 250,000 tons of which was used for washing and textile aids. By 1943, however, natural fat had been replaced to a great extent by the synthetic product for technical purposes. There are three important methods of synthesis today: (1) paraffin oxidation; (2) sulphohalogenation; (3) oxosynthesis. Preparation of synthetic fatty acids by fusion of chlorinated hydrocarbon with potash or by saponification of aliphatic nitro compounds has not yet attained much significance from an industrial point of view. Nor has much progress been made with biological methods of fat synthesis.

Digest from "Preparation of Synthetic Fat Products in Germany" by W. Wachs and J. Reitstötter, *Angewandte Chemie* 20, No. 3, 61-68, 1948. (Published in Germany.)

Argentine Tungsten Production

TUNGSTEN production began in Argentina in 1908 and reached its highest proportions during the years of the two world wars, as shown in the accompanying table. The sharp decrease in production during 1945 and 1946 was due to four reasons: (1) lack of a home market for its consumption; (2) termination of war contracts; (3) increase in cost of production; and (4) uncertainty of getting working permits promptly. Argentina's heavy industry is still in such an embryonic stage that only some 1-2 percent of the minerals produced is consumed locally, the rest being exported chiefly to the United States. It is proposed that a law be introduced to promote tungsten production in Argentina which would cover such points as setting a reasonable price for the producer under different circumstances, permitting the state to collect a stock of tungsten minerals for emergency, controlling employer-employee relationships. Over 30,000 tungsten mine workers are idle in Argentina at present and it is believed that such a law would serve to put the mines back into operation.

Tungsten Mineral Production in Argentina

Year	Tons	Year	Tons
1908	349.6	1927	7.9
1909	753.8	1928	23.8
1910	808.6	1929	42.9
1911	583.8	1930	94.3
1912	637.2	1931	23.2
1913	535.7	1932	5.9
1914	394.2	1933	....
1915	158.2	1934	330.4
1916	760.4	1935	538.7
1917	986.6	1936	639.5
1918	571.6	1937	755.1
1919	181.9	1938	1,039.4
1920	162.5	1939	1,187.0
1921	51.8	1940	1,216.4
1922	111.2	1941	1,589.1
1923	127.9	1942	1,635.5
1924	121.6	1943	2,251.9
1925	4.1	1944	1,886.0
1926	10.3	1945	800.0
		1946	415.0

Digest from "Plan for a Law Covering Tungsten" by H. S. Fernandez, *Industria Minera* VII, 73, 14-16, 1947. (Published in Argentina.)

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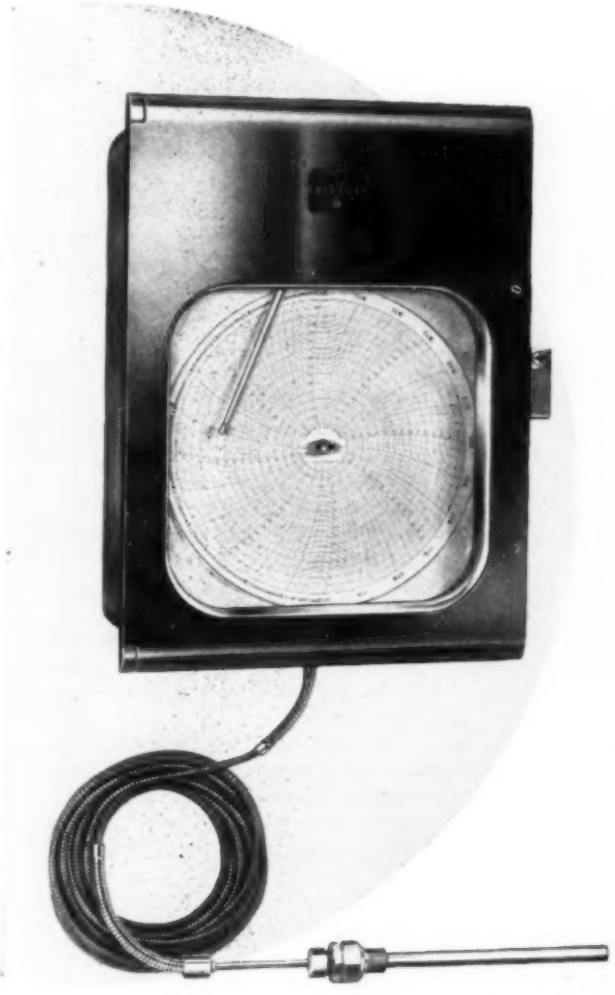

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Linkage . . . flat, strong, adjustable links with polished, stainless steel pins provide sturdy, friction-free connection between measuring element and pen arm mechanism. Easily removed without tools. Measuring-element link arm is adjustable (micrometer type).

Pen Arm Mounting . . . pivoted in stainless steel journals. Shaft supported in rigid, one-piece mounting. Ground and polished stainless steel journals are anti-friction, corrosion-resistant. Backlash and lost motion are eliminated.

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FACTS ON FILTERING

Representative case histories on widely varied clarification problems condensed from field reports of Johns-Manville Filtration Engineers

Solves Filter Problem in new Cotton Seed Oil Solvent Extraction Plant

(reported by J-M Eng. Scott Robbins)
NEW ORLEANS DISTRICT: I had an emergency call from one of my customers whose new filtration unit was not working, and as a result, his solvent plant was shut down. This unit for the solvent extraction of cotton seed oil had only been run two or three hours on separate trials. The filters were only precoated, and after thirty minutes would build pressure up to 45 lb. and stop.

Before we started trial runs, I had them install a small screw dry feeder on top of the precoat tank, and directed the unfiltered oil stream into the top of this tank so that we could have continuous filter aid feed. We precoated one filter with Hyflo at 5 lb. pressure and started the feed.

We filtered 2,500 gal. the first hour and got away ahead of the centrifuge, and for the next hour we recycled from the precoat tank. We started the filter at 10:30 A.M. and filtered for ½ hour, then recycled and finally shut the filter down at 11:30 P.M. At no time did the pressure go over 20 lb. and we had no trouble at all. We used 50 lb. of powder for 7,500 gal. of extract.

Pressure Changes Affect Clarity in Gelatin

(reported by J-M Eng. W. A. Reschke)
CHICAGO DISTRICT: While making a call on one of my customers, I learned that they were experiencing clarity difficulties with their gelatin filtration.

While setting up our field test unit, their chemist mentioned that previously he had observed fluctuating pressures at the filters. We quickly checked and noted a 20 lb. rise and fall due to the steam duplex pump in use

How to get help with your Filtration Problems

If you have a filtration problem of any kind, call in a Johns-Manville Filtration Engineer. Technically trained and thoroughly experienced, he can probably help you find the solution. He may find that a slight change in equipment, operating technique, method of adding filter aid—or a change to one of the high-speed Celite Filter Aids will increase production without affecting filtrate quality. A check-up of your filtering methods will cost you nothing and may save you money. Just address Johns-Manville, Box 290, New York 16, N. Y.

I explained how pressure change would affect clarity and demonstrated this on the test unit as follows:

The filter was precoated with a mixture of Celite 505 and Standard Super-Cel (same ratio as they were using) and after 3 minutes of recirculation, switched to unfiltered gelatin. The clarity of filtrate was judged to surpass the regular product.

Then by opening and closing the bypass I showed the effect of fluctuating pressure on clarity. The filtrate came out cloudy. The filter was then allowed to run normally and the clarity again became excellent. Suggested that insertion of a surge chamber (8½ in. dia. 24 in. long) in the line would minimize surges set up by their steam duplex pump.

Get 80 lb. Improved Yield on 3000 lb. Batch of Beeswax

(reported by J-M Eng. W. J. Bucklee)
PHILADELPHIA DISTRICT: Following a suggestion of mine, a wax products manufacturer made a trial run on filtering African beeswax, using both carbon and a bleaching clay as decoloring agents, and the addition of 15 lb. of Celite 503 on a 3000 lb. batch of the wax. The test was very satisfactory and the work will be continued along these lines.

Of particular interest was their report that 80 lb. of wax was recovered in blowing the press. They attributed this saving to Celite 503 which permitted easier blowing due to the increased porosity of the filter cake.

Perfect Clarity Established in a Few Minutes

(reported by J-M Eng. P. R. Deschere)
NEW YORK DISTRICT: This company filters cider. They had been precoating from a barrel but, after precoating, they had changed connections to run from a 5000 gallon tank without additional filter aid. Although the filter had operated for several days, they had not been able to obtain continued clarity.

A check of the system showed that a booster pump was creating a suction in back of the filter cloths. We removed the pump from the outlet line and discharged directly from the filter to the bottling tank. The bottles received brilliantly clear cider.

By adding 1½ lb. of Hyflo to the filter supply barrel every 10 minutes, it was possible to maintain operations over a long period and keep well ahead of the bottling machine.

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CHEMICAL ENGINEER'S BOOKSHELF

Lester B. Pope, ASSISTANT EDITOR

Evaluation and Forecast

CHEMICAL ENGINEERING ECONOMICS. *Third edition. By Chaplin Tyler. McGraw-Hill Book Co., New York. 321 pages. $4.*

Reviewed by D. B. Keyes

Chaplin Tyler

THE FIRST edition of this book appeared in 1926, and the reviewer had the privilege of commenting on it at that time. In 1926 the chemical engineering economist was a mysterious and unappreciated individual. Today he is still mysterious, but when successful he now receives due credit. The mystery that still shrouds him is largely due to the fact that he, as an individual, has never been classified and given a well-defined field of activity. His title may be almost anything, and he may occupy almost any position of importance within the process industries.

The field itself has never been clearly defined, but as the years roll by it is more and more apparent that chemical engineering economics has to do with the appraisal or evaluation of a chemical development within the process industries; it also deals with the prediction or forecast of the future. This third edition of "Chemical Engineering Economics" stresses these facts.

This new edition stresses the general philosophy underlying development of new chemicals and new chemical processes. Chaplin Tyler, the author, in Chapter 2 gives an excellent resume of the over-all picture. Attention is particularly called to his outline for process development, the basis of any appraisal.

Chapter 3 on plant location by J. L. Warner indicates the complexity of the factors involved in selecting the proper plant location in order to contribute to the success of the venture, —again giving an outline of an appraisal, or evaluation.

Because chemical engineering economics has to do with appraisal and prediction and because of its extreme complexity and lack of mathematical data, the inexperienced reader may consider the subject to be only qualitative or at most semi-quantitative.

Harding Bliss in Chapter 6 has reduced to a quantitative basis the problem of process equipment costs. Roger Williams, Jr., in the same chapter has an interesting discussion of the standardization of cost data on process equipment.

Professor W. H. McAdams in Chapter 7 has indicated the mathematical methods used to determine economic balance. This is the subject that has been used as material for a course in both undergraduate and graduate chemical engineering curricula in our universities, usually very successfully. To the academic and the student mind, this quantitative treatment indicates that the subject is of fundamental value and, therefore, important.

Robert V. Kleinschmidt in Chapter 8 has described the economic balance method as applied to heat and power. Here again, this quantitative treatment of the subject will particularly appeal to university people.

J. L. Bennett in Chapter 9 on plant operation and control stresses the cost estimate. The following chapter on cost accounting by Charles R. Schwartz goes into real detail regarding the preparation of a cost statement. Most technical men are unappreciative of the value and complexity of cost accounting in a chemical plant. Such a review as the one by Mr. Schwartz should be of real value to the young chemical engineer.

Chaplin Tyler in Chapter 11 on market development and research again points out, and in detail, the complexity and importance of such evaluations as a market survey. It is believed that material of this character represents not only the basis of this book, but is of the greatest importance from the standpoint of the reader.

Again in Chapter 14 Chaplin Tyler gives an excellent resume of the functions of management in the process industries.

A. R. Plumley in Chapter 15 outlines the subject of patents. It is recognized, of course, that any outline of this character, due to its extreme brevity, must merely awaken interest in the subject by the reader. The writer has done an excellent job.

No attempt has been made in the foregoing paragraphs to review each and every chapter in this book. The reviewer has selected those sections that would seem to be of particular interest to the reader without regard to whether they were covered thoroughly in the first edition. It is his opinion that this third edition of Chaplin Tyler's book will be of even greater use to the younger chemical engineer in industry and to the chemical engineering student and professor who realize the importance of chemical engineering economics.

First-Year College

QUANTITATIVE ANALYSIS. *Third edition. By Willis C. Pierce and Edward L. Haenisch. John Wiley & Sons, New York. 520 pages. $3.75.*

HERE is a third edition of a fine textbook on quantitative analysis. The book has been greatly revised to bring the second edition, written eight years ago, up-to-date in analytical procedures. Several new procedures have been added, including a discussion on the use of organic precipitants. A new chapter on complex equilibria has also been added.

It is designed to serve as a text in a first-year college course and the authors have succeeded in preparing an excellent book for that purpose.

Chemical Engineering, German

GRUNDRISS DER TECHNISCHEN CHEMIE. *Teil I. Verfahrenstechnik. Von Carl Kroeger. Wolfenbuetteler Verlagsanstalt, G.m.b.H., Wolfenbuettel-Hannover, Germany. 142 pages. RM 12.*

Reviewed by Edgar A. Steck

THIS small book on methods is the first part of a series on chemical engineering principles. The endeavor of

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the author has been to assemble the information to serve more as a guide than as a text, being a teaching aid at a time when few books are available in Germany. The first volume is designed to give the basis of the more important operations in chemical industry, while in subsequent volumes particular emphasis will be placed upon topics in inorganic and organic chemistry, electrochemistry and metallurgy, fuels, cellulose and synthetic fibers, and agricultural chemistry.

It is unfortunate that this "hardship edition" should have to be printed on poor quality paper, for it does appear that Professor Kröger has been quite successful in his attempt to produce a worthwhile guide for German students, who will probably wear it out before they can make practical use of its information. The author has made careful arrangement of the material which was culled from a number of sources, and presents it with clarity. Sufficient emphasis is placed upon the importance of heat, mechanical and electrical energy, and energy transfer to lead easily to the section on the use of machines and operating methods. The interrelationships throughout the whole discussion are clarified through liberal use of tabular summaries. Some two hundred and fifty sketches show the basis of operation of the more important equipment used in chemical engineering. While the theoretical aspects are not especially discussed it is in accord with the treatment of the subject noted by the author. It is rather certain that this carefully written book will prove a valuable adjunct to German instruction of chemical engineering, but not be of particular use in America other than in language courses. We are fortunate enough to have a wealth of fine texts on the subject.

Thesaurus

SYNTHETIC METHODS OF ORGANIC CHEMISTRY. *Vol. I. By W. Theilheimer. Translated by H. Wynberg. Interscience Publishers, New York. 254 pages. $5.*

Reviewed by Edgar A. Steck

FOR a number of years the lack of a systematic, comprehensive and current compilation of synthetic methods has been noted, because the treatise by Houben has become dulled during the years of research. The need for adequate surveys of the literature has been filled in certain special fields by "Organic Reactions" and "Newer Methods of Preparative Organic Chemistry." But even the work by Weygand has not treated the whole problem. It has been necessary for most research

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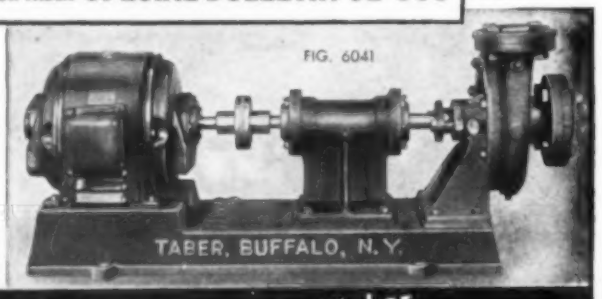

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workers to assemble their own variety of files on methods. A considerable portion of the effort expended in this task may be devoted to laboratory work, for in this volume there is the beginning of an excellent series designed to be an active "Beilstein" of methods. The reviewer, having had nearly a decade of experience in building his "working files," was fortunate enough to discuss some matters with Dr. Theilheimer, and finds good reason to endorse the system with considerable enthusiasm.

The classification of synthetic methods has been based upon bond-formation during reactions, and symbols are employed to distinguish between transformations involved. Only in the matter of ring transitions does the reviewer find reason for exception with the scheme used. For those not preferring the basic indexing given by the transformations, there is a subject index. Chemists will owe an increasing debt to the painstaking efforts of Dr. Theilheimer, for, after covering 1945–1946 in Vol II, further volumes will appear at yearly intervals.

The translation of "Theilheimer" seems to have been accomplished because English is becoming ever more the language of science. This is of interest for little more reason. In handling the splendid work, the helpful symbols for reactions have vanished from the top of each page, leaving the number of the example and page. This alteration is regrettable. While it is very desirable to have references to the original publication and Chemical Abstracts (in place of the Chemisches Zentralblatt), it would seem well to give the volume as well as year of CA.

There are very few errors in this well-printed book which is bound as sturdily as one would wish of a valuable handbook. It may be noted that the translation has been produced at a lower cost than the original.

Profound

THEORY OF THE STABILITY OF LYOPHOBIC COLLOIDS. *By E. J. W. Verwey and J. Th. G. Overbeek. Elsevier Publishing Co., New York. 203 pages. $4.50.*

Reviewed by Jerome Alexander

THIS important mathematical discussion gives the results of theoretical investigations carried on intermittently during the war years 1940–1944, with some more recent work, all heretofore unpublished in journals. The book aims to develop, as far as possible, a quantitative theory of the stability of hydrophobe colloids and suspensions, based essentially on a balancing of (1) mutual repulsions of particles due to

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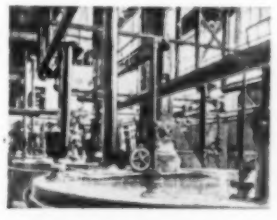

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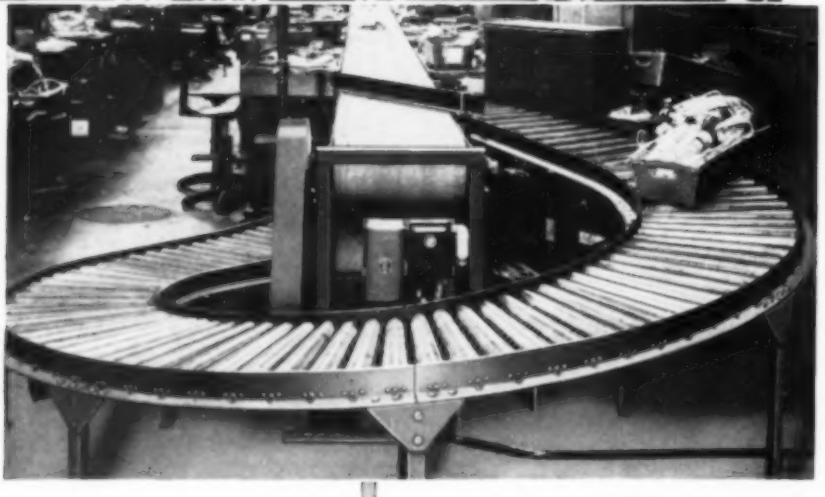

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interaction of two electrochemical double layers, and (2) attractions due to London-Van der Waals forces. Incidentally, there emerges a quantitative explanation for the well-known Schulze-Hardy lyotrope series. Certain deviations from this rule are explained by consideration of O. Stern's theory, which introduces explicitly the specific adsorbability and dimensions of the ions involved. Repeptization phenomena necessitate introduction of the Born repulsion, which, apart from this, has minor influence on stability properties.

Part I (three chapters) deals with the single double layer. Part II (four chapters) deals with the interaction of two flat plates, and develops much of the theoretical results. Part III (five chapters) considers the interaction of spherical particles, and clarifies various details, e.g., the influence of particle size and the kinetics of flocculation. An Appendix gives a critique of the theoretical work of other authors, including P. Bergmann, P. Low-Beer, H. Zocher, B. Derjugian, I. Langmuir, S. Levine and G. P. Dube, A. J. Corkill and and L. Rosenhead. Among the many biologically and technically important questions considered are flocculation, gelation, thixotropy, Schiller layers, tactoids, rheopexy, rheological and mechanical behavior of suspensions (Osborne Reynolds dilatency), etc.

Because of the basic nature of the principles treated, this book has much of profound interest to physicists, chemists, biologists and technologists. It is well printed and bound.

History

THE CHEMICAL WARFARE SERVICE IN WORLD WAR II: *A Report of Accomplishments. Reinhold Publishing Corp., New York. 222 pages. $4. Order from Armed Forces Chemical Association, Room 523 Portland Building, 1129 Vermont Ave., N.W., Washington 5, D. C.*

Reviewed by Gordon W. McBride

PRINCIPAL activities and accomplishments of the Chemical Warfare Service in World War II are given in compact and readable form in this small volume, publication of which was sponsored by Chemical Corps Association, predecessor of Armed Forces Chemical Association. Details and complete coverage of the CWS will be given as part of a 5-volume history of the United States Army, now in the course of preparation. Pending completion of this elaborate history some years hence, this condensed account of CWS operations will be quite satisfactory. In our opinion, it will probably

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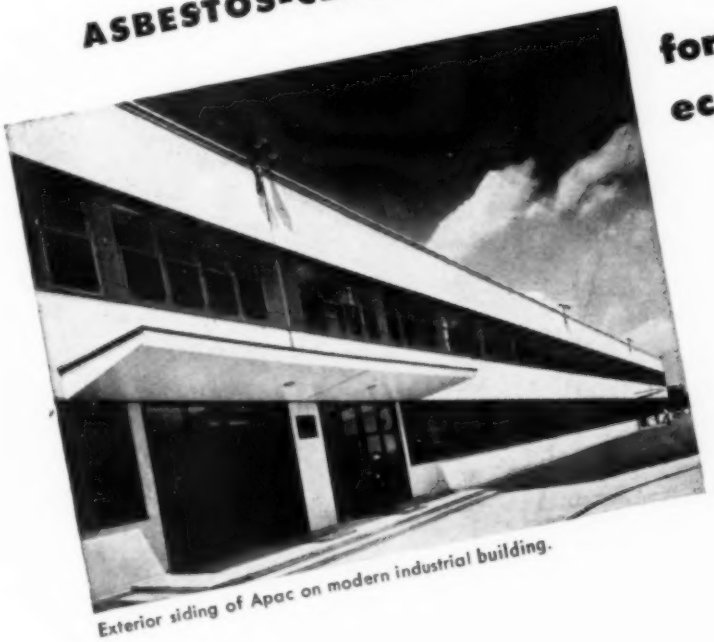

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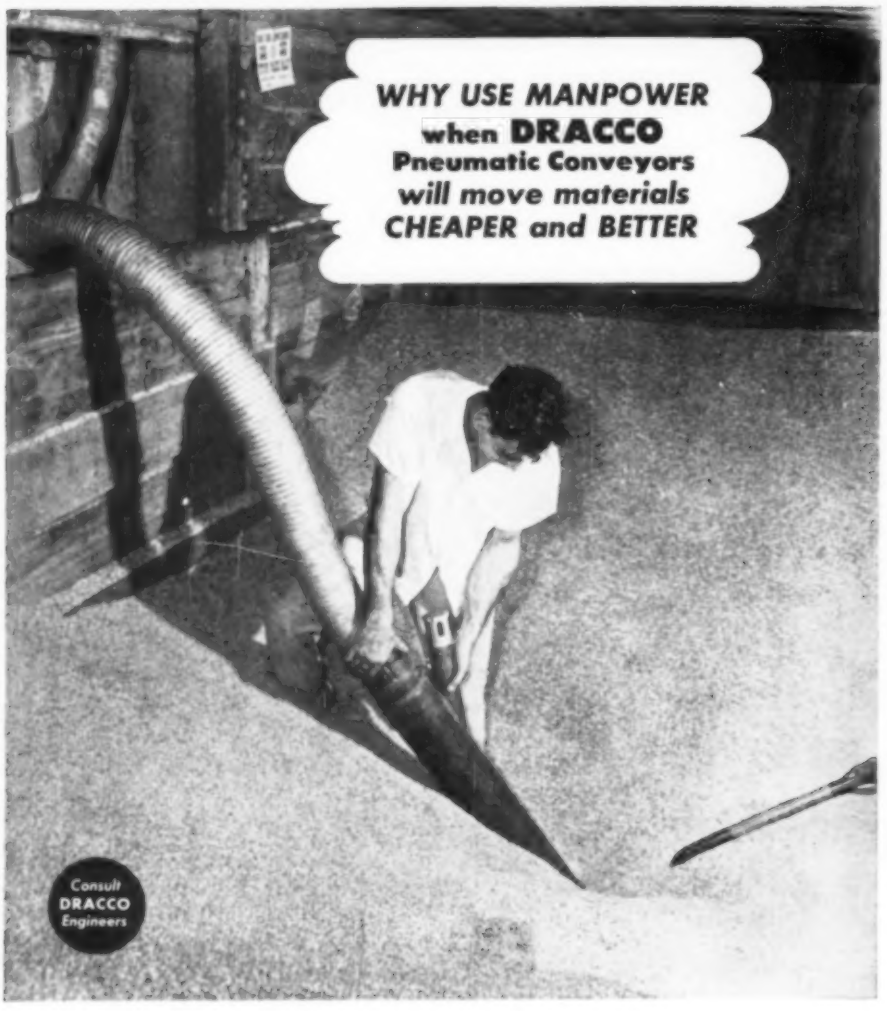

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A brief review of the CWS prior to World War II opens the volume. A series of organization charts for the period 1940 to 1945 comes next, including an outline of the chemical organization in various theaters of operations.

Research and development account for nearly 50 pages of technical and historic narrative. Procurement and supply of CWS materiel, training of service and combat troops, and a discussion of the readiness for gas warfare complete the general presentation. The CWS mission in various theaters of operation and a number of chapters on principal chemical warfare equipment brings back in considerable detail the wartime communiques.

Peacetime byproducts from the implements of war are discussed in the closing chapter of the book. Among the outstanding which are mentioned are types of spraying equipment and smokepots useful in agriculture, similar farm and forest uses of flame throwers and CWS fuels, protective clothing, plant growth regulators, and medical ointments and antidotes.

Statistical appendixes complete the volume, including a list of principal contractors for CWS broken down by states. Liberal use of satisfactory illustrations help make this a book which chemical engineers will be pleased to read and have on their shelves.

Phosphor Research

SOME ASPECTS OF THE LUMINESCENCE OF SOLIDS. *By F. A. Kröger. Elsevier Publishing Co., New York. 310 pages. $5.50.*

Reviewed by Arthur L. Smith

THIS monograph is of interest primarily to those engaged directly in the preparation or theory of luminescent solids. It is based mainly on experimental work (some previously unpublished) conducted in the Physical Laboratory of the N. V. Philips' Gloelampenfarbricken, Eindhoven, on oxide type phosphors—silicates, aluminates, titanates, phosphates, etc. Particular attention is given to manganese and titanium as activators. The interpretation of the results (and some results as well) is often in conflict with those of other investigators, but this lack of agreement is not unusual in the study of luminescent solids. Dr. Kröger is to be commended for bringing a fresh approach to many complex problems, but further substantiation of some of his ideas by others will be necessary before this reviewer can accept them unconditionally.

Of particular interest is a series of

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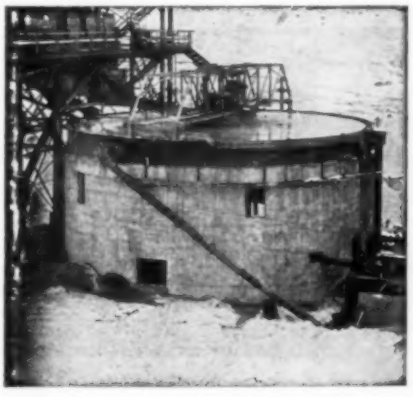

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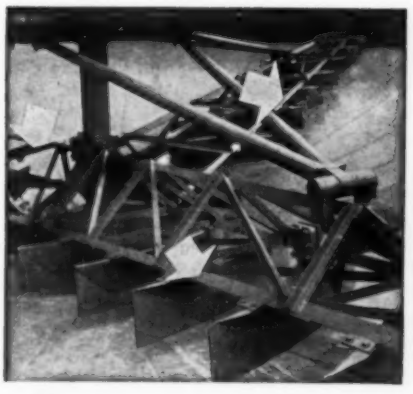
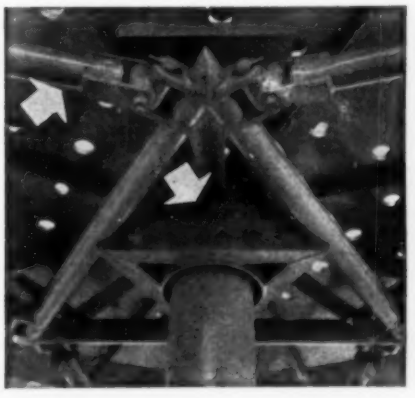
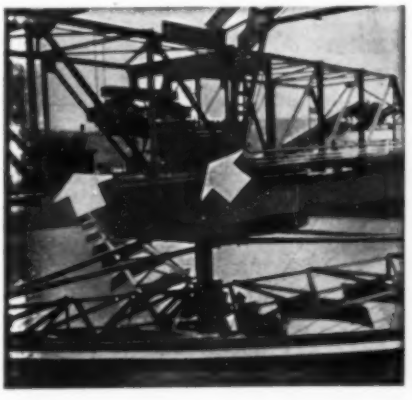


Maximum strength and rigidity are accomplished through the use of triangular construction. For instance, rake blades are mounted on *three* rotating arms, driven by pivoted drive rods.



Drive rods from each rake arm are connected in turn to the central drive tube as shown above . . . a further development of rigidity through the use of triangular construction.



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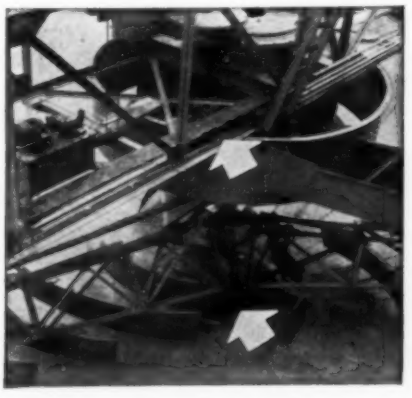

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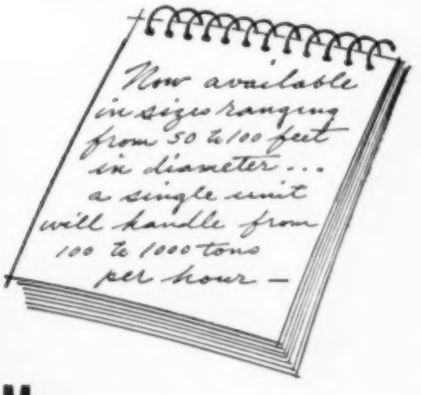

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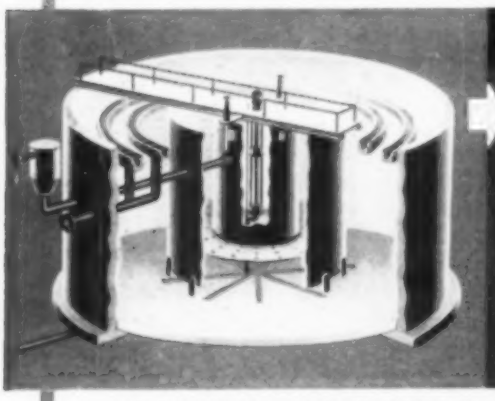

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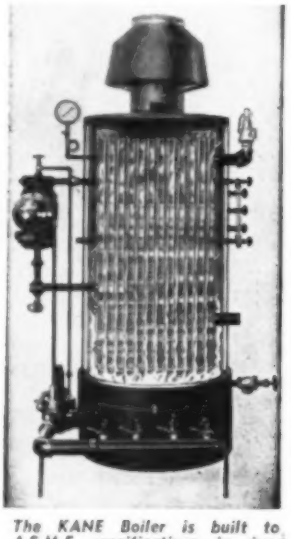

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tables in which are compiled most of the reported inorganic luminescent materials together with original references to their preparation and properties. The extensive bibliography is extremely useful.

Because of the narrow range of the field which is covered it is not recommended "primer reading" of the subject, but it is "must" reading for those engaged in phosphor research or preparation.

The book reflects foreign printing; poor quality paper, considerable misspelling and occasionally stilted English.

Biochemistry

ADVANCES IN ENZYMOLOGY, *Vol. VIII. Edited by F. F. Nord. Interscience Publishers, New York. 538 pages. $8.*

SIMILAR to previous volumes in this series, this book is comprised of rather comprehensive treatment of different phases of enzymology and biochemistry. Authors of individual chapters are recognized authorities in their respective fields, located in the U. S. and in foreign countries, such as Sweden, Switzerland, Czechoslovakia, and Turkey. The ten sections of the book are entitled: Functioning of the Cytoplasm, Quantitative Studies on Complement, Dehydropeptidase, Anti-Fatty Liver Factor of the Pancreas, Alkaloid Biogenesis, Certain Aspects of the Microbiological Degradation of Cellulose, Synthesis of Lipides, Biochemistry of Fatty Acid Catabolism, Lipoxidase and the Autoxidation of Unsaturated Fatty Acids, Enzymes of Snake Venoms and Their Biological Significance. An excellent feature of the book is the cumulative index covering Volumes I through VIII of this series.

RECENT BOOKS and PAMPHLETS

Diesel Fuel Oils, Production, Characteristics, and Combustion. Published by the American Society of Mechanical Engineers, 29 West 39th St., New York. 128 pages. Lectures delivered at 19th ASME National Oil and Gas Power Conference, May 20, 1947.

Turf Weed Control with 2,4-D. By Fanny-Fern Davis. Published by Hobart Publishing Co., Washington, D. C. A report to National Capital Parks. An excellent resume of actual experience, advantages, and precaution in use of 2,4-D on park lawns in Washington, D. C.

Methyl Isobutyl Ketone. Technical Publication SC: 48-1, published by Shell Chemical Corp., 100 Bush St., San Francisco. 98 pages. Gratis. Properties and applications.

Chemical and Physical Investigations on Dairy Products. By H. Eilers, R. N. J. Saal and M. van der Waarden. Published by the Elsevier Publishing Co., 215

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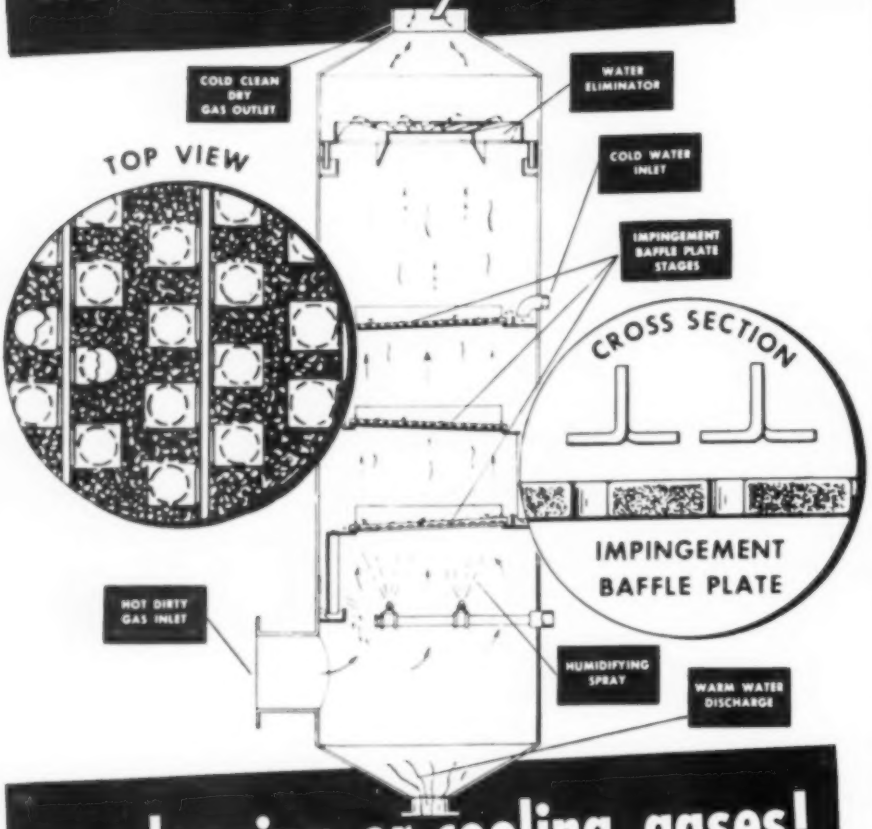

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Fourth Ave., New York 3, N. Y. 215 pages. One of a series of "Monographs on the Progress of Research in Holland."

World Fiber Survey. Published by Food and Agriculture Organization of the United Nations and distributed by Columbia University Press, New York City. 186 pages. $1.00 per copy. This survey reviews the basic factors statistically, including production, consumption, trade, and current world situation for all classes of natural and synthetic fibers, including glass.

Symposium on Paint and Paint Materials. Special Technical Publication No. 75, published by the American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. 115 pages. $2. Ten technical papers together with a discussion on "Test Methods and the Paint Industry."

A.S.T.M. Standards on Soaps and Other Detergents. Prepared by A.S.T.M. Committee D-12 On Soaps and Other Detergents. Published by the American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. 170 pages. $2. Specifications, methods of analysis, definitions of terms.

Methanol. Chemical Safety Data Sheet SD-22, published by Manufacturing Chemists' Association, 608 Woodward Building, Washington 5, D. C. This is one of the series on "Properties—Essential information for safe handling and use." 14 pages. 20 cents.

Standard Methods for Testing Petroleum and its Products. Ninth Edition. Published by the Institute of Petroleum, Mansion House, 26 Portland Place, London, W.1., England. 616 pages.

Yeast From Florida Sulfite Waste Liquor. By Robert D. Walker, Jr. Technical Paper No. 16, published by the Florida Engineering and Industrial Experiment Station, College of Engineering, University of Florida, Gainesville, Fla. 8 pages.

A.S.T.M. Specifications for Steel Piping Materials. Fifth edition. Published by the American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. 315 pages. $3.

The Fracture of Metals. By Maxwell Gensamer, Edward Saibel, John T. Ransom and Robert E. Lowrie. Published by the American Welding Society, 33 West 39th St., New York 18, N. Y. 84 pages. $1. A report to the Bureau of Ships, U. S. Navy.

The Sanitary Research Laboratory of the University of Florida. By Earle B. Phelps and D. L. Emerson, Jr. Bulletin No. 20, published by Florida Engineering and Industrial Experiment Station, College of Engineering, University of Florida, Gainesville, Fla. 34 pages.

Compressed Air in Action. Published by the Committee on Engineering Education, Compressed Air and Gas Institute, Rm. 1104, Terminal Tower Bldg., Cleveland 13, Ohio. 20 pages. Illustrated lecture about compressed air equipment and some of the uses of compressed air.

Some Basic Techniques in Materials Handling. Published by Clapp & Poliak, Inc., Empire State Building, New York, N. Y. 84 pages. $1. Proceedings of the Technical Sessions held concurrently with the Second National Materials Handling Exposition in Cleveland last January.

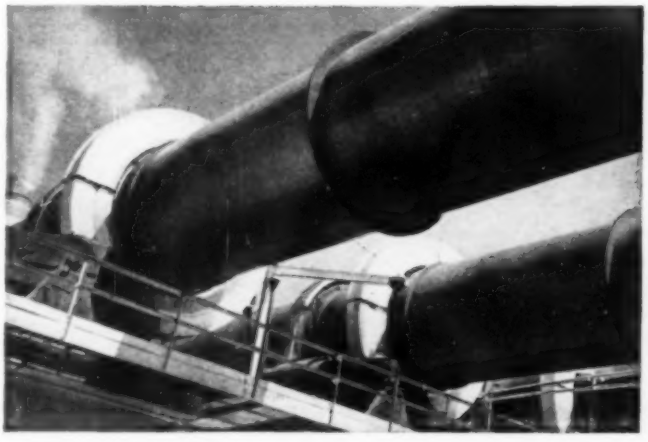
Handbook of the Scientific Instrument Manufacturers' Association of Great Britain, Ltd. Published by the Scientific Instrument Manufacturers' Association of Great Britain Ltd., 26 Russell Square, London, W.C.1., England. 219 pages. 10s./6d. Alphabetical index of the products made by the member-firms of the Association and a list of the firms with their products.

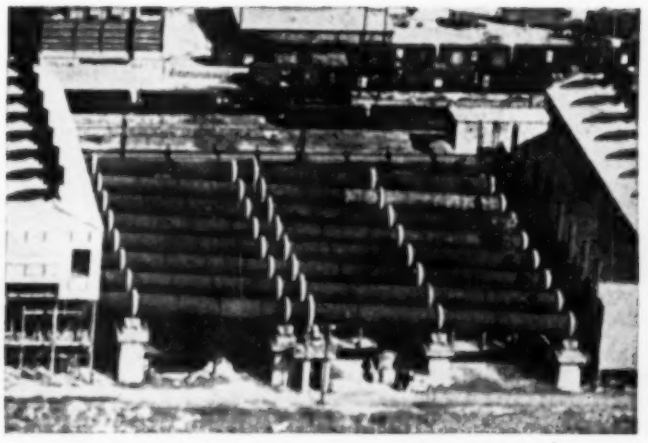
Filing Systems for Engineering Offices. Published by the Engineering Societies Library, 29 West 39th St., New York 18, N. Y. 6 pages. $2. Selected list of 41 references to books and articles on systems for the filing of notes, correspondence, abstracts, reprints, drawings, maps, catalogs, etc.

Resins for the Paper Converter. By George C. Borden, Jr. and Samuel S. Gutkin. TAPPI Monograph Series—No. 5, published by the Technical Associa-

Rotary Kilns by the Mile

for a single Traylor customer





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Traylor is pleased to be part of the continuing success of old customers . . . eager to help new customers make the most of their opportunities.

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ALL-WELDED STEEL SHELLS. The shells of Traylor kilns are made of thick steel plates welded together to obtain single section rigidity. Reinforcing rings strengthen all circumferential joints.

TURNED AND FACED RIDING RINGS. Riding rings on Traylor kilns are turned and faced to a true, smooth finish. They are attached to the shells without bolts or rivets.

IMPROVED SUPPORTS. Kiln alignment is easily maintained by specially designed supports. One support on each kiln is equipped with tapered thrust rollers.

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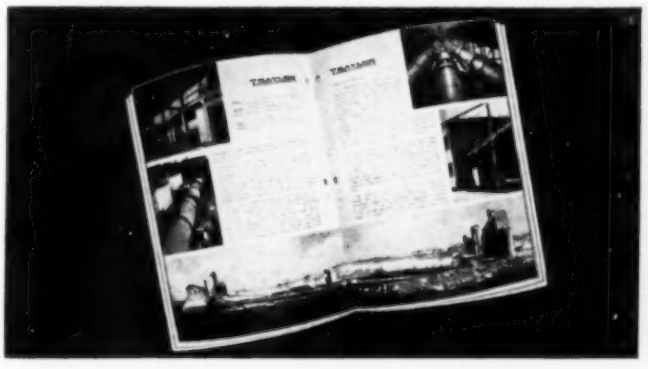

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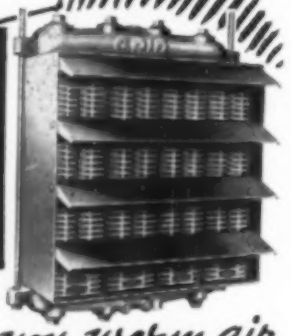

that gives you warm air in greater volume at the working level

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This means a saving in the fuel bill, while assuring warm comfortable air to the working areas. Only by eliminating stratification of warm air at ceiling level can you get the ultimate from your heating dollar.

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Don't be confused by unit heaters offering great BTU delivery and high outlet temperatures; you may be heating your ceiling. BTU in a unit heater does not mean everything . . . it's the CFM and low outlet temperature that really count. If you want to save on your fuel bill, install GRID this heating season.

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tion of the Pulp and Paper Industry, 122 East 42nd St., New York, N. Y. 95 pages. Tabulation and evaluation of those resins in commercial production today which are of importance to the paper converter.

Lignin Chemistry and Utilization. Bulletin No. 19, published by the Northeastern Wood Utilization Council, P. O. Box 777, New Haven, Conn. 135 pages. $2. Report of a conference held at New Haven, Sept. 19, 1947.

New Developments in Ferromagnetic Materials. By J. L. Snoek. Published by the Elsevier Publishing Co., 215 Fourth Ave., New York 3, N. Y. 136 pages. $2.50. One of a series of "Monographs on the Progress of Research in Holland."

GOVERNMENT PUBLICATIONS

The following recently issued documents are available at prices indicated from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. In ordering publications noted in this list always give complete title and the issuing office. Remittances should be made by postal money order, coupons or check. Do not send postage stamps. When no price is indicated, pamphlet is free and should be ordered from the bureau responsible for its issue.

Developed and Potential Water Power of the World. U. S. Geological Survey. Mimeographed. A statistical summary with data for every part of the world.

National Security Factors in Industrial Location. National Security Resources Board, Document 66. Revised July 22, 1948. Mimeographed. Recommends methods and considerations for plant sites to avoid congested areas subject to potential bombing.

Selected Types of Fertilizer 1939 to 1946—Trends in Man-Hours Expended Per Ton. Bureau of Labor Statistics. Statistical resume of elements of cost analyzed for a period of years in terms of productivity per man-hour.

Utilization of Idle Equipment in Distilleries for Production of Potato Flour. By Paul W. Edwards, et al. Bureau of Agricultural and Industrial Chemistry, AIC-190. Processed. Available from Eastern Regional Research Laboratory, Philadelphia 18, Pa. Gives flowsheet and recommends process for plant adaption.

Lactic Acid—Versatile Intermediate for the Chemical Industry. By C. H. Fisher and E. M. Filachione. Bureau of Agricultural and Industrial Chemistry, AIC-178. Processed. Available from Eastern Regional Research Laboratory, Philadelphia 18, Pa. Suggested methods for production with bibliography.

Spectral Transmissive Properties and Uses of Eye-Protective Glasses. National Bureau of Standards, Circular C471. Price 10 cents. A comprehensive report on types of lenses for safety without loss of visibility.

Textile Testing Equipment. National Bureau of Standards, Letter Circular LC907. Mimeographed. Essentially a list of equipment suppliers and types of apparatus available for the textile laboratory.

Standard Fading Lamp and Method of Calibrating Lamps Used in Testing Colorfastness to Light. National Bureau of Standards, Letter Circular LC906. Mimeographed.

Summaries of Tariff Information. U. S. Tariff Commission. Processed. A series of some 20 volumes of which 6 have thus far appeared, summarizing production, import, and export data, for all commodities in the tariff law. These docu-

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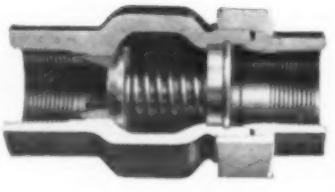

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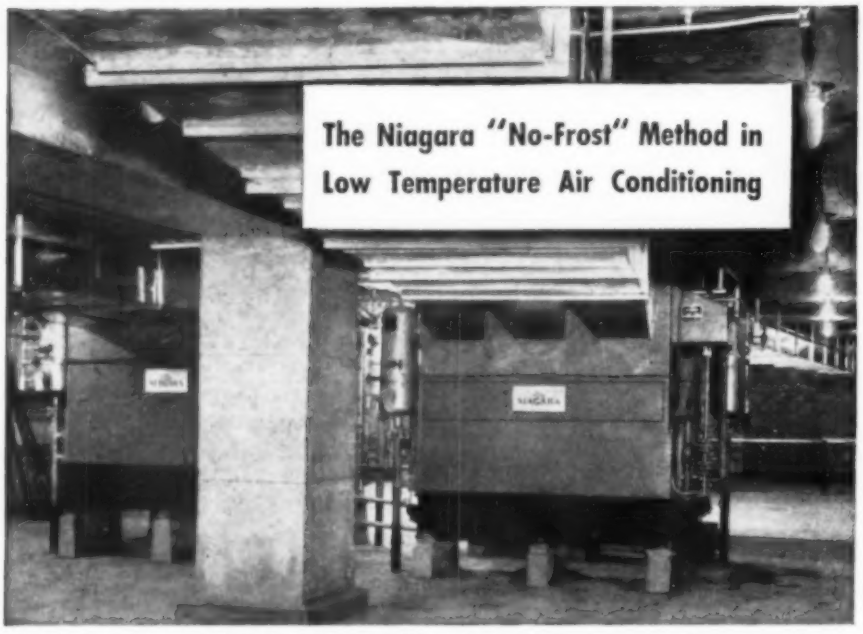

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ments are not available for general distribution, but may be consulted at branch or regional offices of the Commission or of the Department of Commerce and in some technical libraries.

Atomic Energy Documents. United States Atomic Energy Commission is issuing a series of lists of documents. Those wishing to receive these bibliographic notices should address United States Atomic Energy Commission, Document Sales Agency, P. O. Box 62, Oak Ridge, Tenn.

Malaria Control on Impounded Water. U. S. Public Health Service. Price $2. cloth. Manual presenting basic principles and modern practices of malaria control.

Collective Bargaining Provisions. Bureau of Labor Statistics, Bulletin No. 908-2. Price 15 cents. Summarizes contract and agreement provisions with respect to holidays, vacations, and weekend work.

Joint Labor-Management Safety Conferences. Division of Labor Standards, reprint. Digest of the three joint labor-management safety conferences held during 1946 by the pulp and paper industry, Washington, Oregon, and California.

Cottonseed Handling with Small Air Pipes. By Charles A. Bennett and Gerald N. Franks. U. S. Department of Agriculture Circular No. 768. Price 5 cents. Applicable also to other air-handling problems.

Mint Farming. By A. F. Sievers and E. C. Steven-on. U. S. Department of Agriculture, Farmers' Bulletin No. 1988. Includes description of equipment for recovery of mint oil by steam distillation.

Laboratory and Field Tests of Additional Organic Compounds Against the European Corn Borer. By D. D. Questel and S. I. Gertler. Bureau of Entomology and Plant Quarantine, E-748. Processed. Supplements four previous publications.

Weeding Small Grain and Corn with 2, 4-D. U. S. Department of Agriculture Fact Sheet, OFFC-8. Includes definition of proper rules for application and precautions in use.

Save Cottonseed from Insects. U. S. Department of Agriculture Fact Sheet, OFFC-M-2. Gives a correlation between individual pests and the preferred chemicals for fighting them.

Quarterly Industrial Financial Report Series for All United States Manufacturing Corporations, Fourth Quarter, 1947. Available on request to Federal Trade Commission or Securities and Exchange Commission. Processed. A statistical summary on which extent of industrial activity can be estimated.

Statistics of Income, Part 2. Bureau of Internal Revenue. Price 10 cents. Preliminary report of corporation income and declared value excess-profits tax returns and corporation excess profits tax returns for 1945, filed through Dec. 31, 1946.

Explanation and Interpretation of Analyses of Irrigation Waters. By L. V. Wilcox. U. S. Department of Agriculture, Circular No. 784. Price 5 cents.

Structure, Determined by X-Ray, and Strength of Cotton Fiber. By Earl E. Berkley, et al. U. S. Department of Agriculture, Technical Bulletin No. 949. Price 20 cents.

Decay and Termite Damage in Houses. U. S. Department of Agriculture, Farmers' Bulletin No. 1993. Price 10 cents.

Corncobs—Their Composition, Availability, Farm and Industrial Uses. By E. C. Lathrop and J. H. Shollenberger. Bureau of Agricultural and Industrial Chemistry, AIC-177. (Supersedes ACE-190). Mimeographed. Available from Northern Regional Research Laboratory, Peoria, Ill. Resume with suggestions of possible industrial development.

Facts About the Industrial Utilization of Straw. Bureau of Agricultural and Industrial Chemistry, AIC-189. Mimeographed. Available from Northern Regional Research Laboratory, Peoria, Ill.

Grass. 1948 Agriculture Yearbook. U. S. Department of Agriculture. Price $2., cloth. Includes resume of present chem-

R-S valvEvents

ISSUED PERIODICALLY BY R-S PRODUCTS CORPORATION, PHILADELPHIA 44, PA., FOR THOSE CONCERNED WITH FLOW CONTROL AND SHUT-OFF

Now Tulsa Can Water its Lawns Again

Fred Gibson, Philadelphia truck driver, made it to Tulsa in 4 days from the R-S plant in Philadelphia with two big 60-inch R-S Valves riding out back on his truck.

These completed a shipment of 5 big R-S Valves for the Tulsa water supply system. The others are 54-inch valves.

All are R-S cast iron valves, cylinder-operated in connection with liquid level control for water service. All have handwheel and declutching unit for manual control. Angular seated vanes are lapped in for wedge-type closure.

Tulsa and surrounding areas have been suffering from a water shortage, now corrected by the new flow through the big R-S Valves controlling the new Spavinaw flow line which will deliver 35,000,000 gallons daily.

The movement and installation of the big valves was a carefully organized job. Because of speed required, full double crews were assigned so work could proceed day and night. All crews were carefully schooled in each step of procedure and in the sequence of operations.

Annyhoo, the new lines will soon be in operation; the big R-S Valves doing their stuff as usual, and Tulsa's citizens will be free of the irksome water shortage.

This is another example of the growing popularity of R-S Valves in all sizes including the largest.

New Distributor for R-S Valves in Cincinnati

The Henry P. Thompson Company, Schmidt Building, Cincinnati 2, Ohio have been appointed to represent R-S Valves in the Cincinnati area. Their territory includes Southwest Ohio, Southeast Indiana, and part of Kentucky.

The Thompson Company is an old established engineering firm. Herbert N. Haas, owner, is a graduate engineer of the University of Pennsylvania. Associated with him are John S. Bower and Kenneth C. Matthews, also graduate engineers. All are thoroughly schooled in valve engineering.

Today every R-S unit is properly engineered throughout under recognized standards for various industries such as A.S.A., A.P.I., A.S.M.E., etc. and backed up in the field by Valve Engineers.

Escalator Clauses Gripe Us, Too!

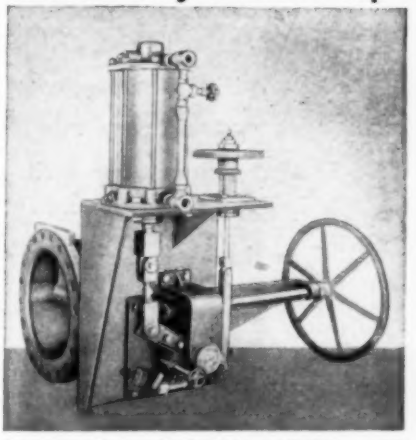
We don't even like to put one in our own contracts with customers, but wotta we gonna do?

All in one week pig iron, iron scrap, steel plate, nickel, electric motors and accessories went up from 10% to nearly 20%. All suppliers of these items have escalator clauses in their contracts.

Naturally, we have one too, to make it possible for us to stay in business.

But we don't like it any better than you do!

R-S Valve features NEW Outside Adjustable Stop



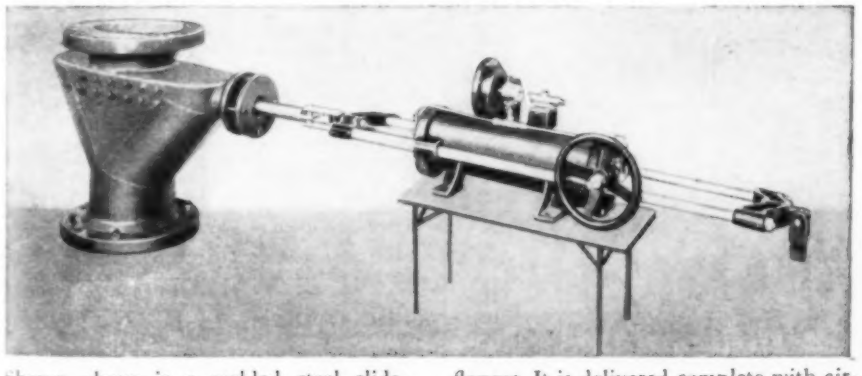
Picture shows R-S Valve #714, a 20-inch 125-pound valve with the R-S Rubber Spool (patent pending) for positive shut-off. Control is by air cylinder, cushioned at both ends. Handwheel and declutching unit are provided.

An outside adjustable stop supplies an auxiliary air cushion and may be set to control maximum opening of vane at any point from 50% to 100% open. This vane moves from full open to full closed position in 1 second.

Operating mechanism can be timed for slow movement if desired by adjusting snubbing valve in air-supply line to cylinder.

Large cylinder can be supplied for air, oil, or water pressure as actuating medium. High speed is normally provided with air only.

R-S Adds New Slide Valve for service in Cracking Unit



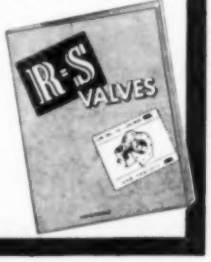
Shown above is a welded steel slide-valve, R-S #713, for handling high temperature catalyst in a cracking unit for petroleum service.

The valve is fitted with Series 30 300-pound American Standard ring-joint flanges. It is delivered complete with air-cylinder positioner and auxiliary handwheel control.

This R-S Valve is available with other types of automatic controls or with manual operator only, if desired.

The New R-S Valve Catalog #17

R-S Valve Catalog #17 is packed with information for engineers. There are over 70 halftone pictures of R-S Valves . . . working drawings of 21 types of R-S Valves with standard controls and fittings and complete dimensional data for all sizes . . . working drawings of 22 types of prime movers . . . numerous other diagrams, graphs and miscellaneous drawings. Address R-S Products Corporation, Valve Division, Philadelphia 44, Pa.



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FROM: NORWALK COMPANY

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ical and biologic knowledge including much information regarding fertilization, pest control, and animal feeding.

A Method for the Determination of Freon-Insoluble Matter in Pyrethrum Extracts. By A. C. Hazen and Robert A. Fulton. Bureau of Entomology and Plant Quarantine, ET-257. Processed.

Concentratability of Birmingham, Ala., Red Iron Ores by Separation in Heavy Media. By B. H. Clemmons, et al. Bureau of Mines, Report of Investigations R. I. 4249. Mimeographed. Work done by the bureau in cooperation with the University of Alabama.

Investigation of Ore-Dressing Methods for Barite Ores from New Mexico, Missouri, and Arkansas. By M. M. Fine and J. S. Kennedy. Bureau of Mines, Report of Investigations R. I. 4280. Mimeographed.

Laboratory Concentration of Complex Sulfide-Oxide Ore from Shenandoah-Dives Mine, Silverton, Colo. By Heine Kenworthy. Bureau of Mines, Report of Investigations R. I. 4283. Mimeographed.

Metallic Manganese Metallurgy in Japan. By Philip P. Dettmer. Bureau of Mines, Mineral Trade Notes, Special Supplement No. 22 (to Vol. 26, No. 1). Mimeographed.

National Motor-Gasoline Survey, Winter 1947-48. By O. C. Blade. Bureau of Mines, Report of Investigations R. I. 4354. Mimeographed.

Investigation of the Mateen Spodumene Deposit, Pennington County, S. Dak. Bureau of Mines, Report of Investigations R. I. 4339. Mimeographed. Summary of potential lithium supply in this area.

Ammonium Nitrate: Its Properties and Fire and Explosion Hazards (A Review with Bibliography). By G. S. Scott and R. L. Grant. Bureau of Mines, Information Circular I.C. 7463 Mimeographed.

A Method of Evaluating Bleaching Clays. By Donald W. Ross. Bureau of Mines, Report of Investigations R. I. 4295. Mimeographed. Test procedures recommended and results of experimental work on various process industries.

Extraction of Alumina from High-Iron Bauxites. By Frank J. Cservenyak, et al. Bureau of Mines, Report of Investigations R. I. 4299. Mimeographed. Pilot-plant tests employing the lime-soda sinter process.

Some Observations on Coking Practice in Germany. By Frank H Reed. Bureau of Mines, Information Circular I. C. 7462. Mimeographed. Two portions of a report of the Solid Fuels Mission: Part I. Metallurgical Coke. Part II. Slanting Type Didier Coke Ovens, Stadtische Werke Karlsruhe.

Critical Review of Chemistry of Oxo Synthesis for Production of Alcohols from Olefins, Carbon Monoxide, and Hydrogen, with discussion of reaction mechanism for oxo and related syntheses. By Irving Wender and Milton Orchin. Bureau of Mines, Report of Investigations R. I. 4270. Mimeographed

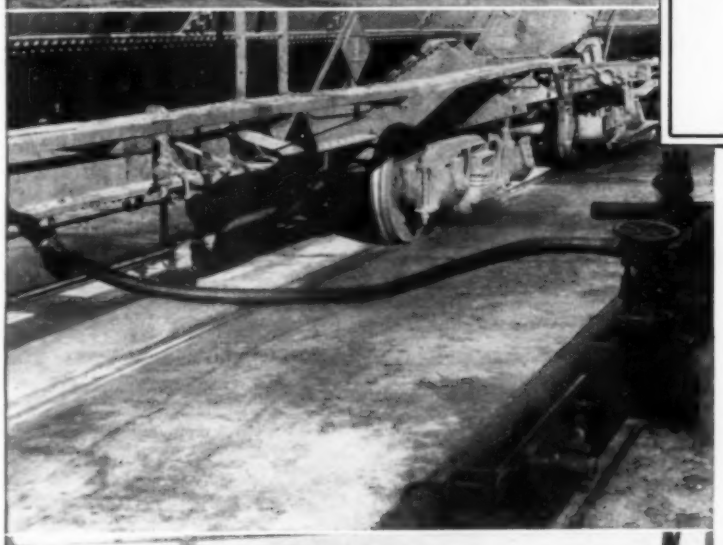
Laboratory Methods for Evaluating Materials for Mineral-Wool Production. By S. M. Molloy and W. A Calhoun. Bureau of Mines, Report of Investigations R. I. 4296. Mimeographed. Includes summary of extended experimental work.

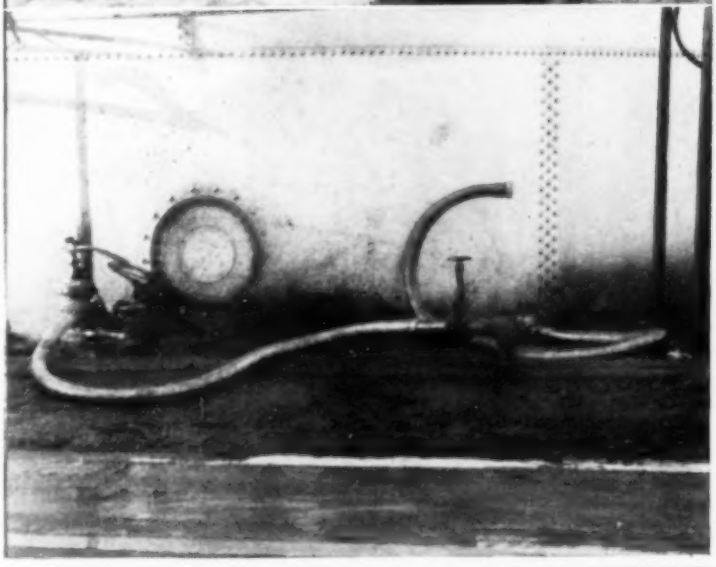
Bibliography of Reports Containing Analyses of Crude Oils by the Bureau of Mines, Routine Method. By Elizabeth Hughes and O. C. Blade. Bureau of Mines, Information Circular I. C. 7470. Mimeographed.

Determination of Moisture in Coal with the Brabender Semi-Automatic Tester. By H. M. Cooper, et al. Bureau of Mines Report of Investigations R. I. 4304. Mimeographed.

Effect of Acid Oxides Upon Desulfurization in the Iron-Manganese System. By M. B. Royer and A. J. Williams, Jr. Bureau of Mines, Report of Investigations R. I. 4300. Mimeographed.

Methods of Test for Evaluating the Properties of Building Board. No. R1712. Available only from Forest Products Laboratory, Madison 5, Wis. Processed.





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Write today for complete information on how Rex-Tube RT-15, can serve you economically and dependably. Data sheets and specifications furnished on request.

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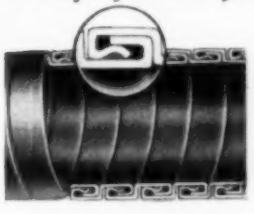

REX-TUBE TYPE RT-15—Fully interlocked flexible metal hose. Sizes ⅜" thru 12", I.D. Suitable for temperatures to 600°F and pressures to 500 psi.

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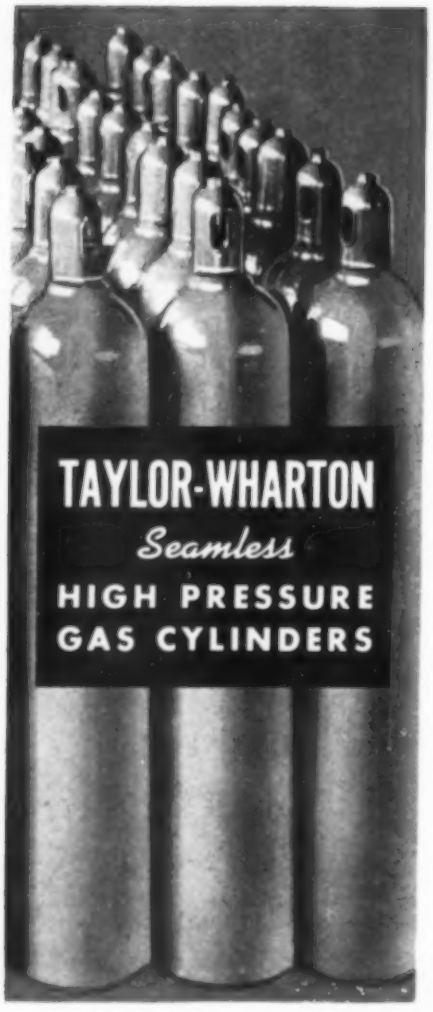
Plants at Maywood, Elgin and Rock Falls, Illinois

In Canada: Canadian Metal Hose Company, Limited, Brampton, Ontario



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MANUFACTURERS' LATEST PUBLICATIONS

Chemical Engineering's Reader Service, in cooperation with manufacturers, makes it possible for you to secure catalogs, bulletins, and other publications herein listed without obligation (unless a price is specifically mentioned). For your convenience, publications may be obtained by using Reader Service Coupons on pp. 175-176.

(Continued from page 176)

describes the large induction motors made by this company. Contains charts of electrical characteristics, representative full load power factors, and approximate range of starting torques, of squirrel-cage motors larger than 200 hp. Different types and models of motors are illustrated, and features of construction are shown in some detail.

115. Protective Coatings. Alkydol Laboratories, Inc., Cicero, Ill.—4-page mimeographed bulletin describes the synthetic vinyl resins made by this company for use in varnishes.

116. Sand Filter. Hardinge Co. Inc., York, Pa.—4-page leaflet illustrating and describing this company's automatic backwash rapid sand filter for sanitary engineering application.

117. Heating Coils. McQuay, Inc., Minneapolis, Minn.—32-page catalog No. 300 illustrates and describes the non-ferrous extended surface heating coils made by this company. Features of construction are shown, dimensions are given, and various hook-ups are illustrated. Also a heating coil data bulletin containing tabulated engineering and performance data for the heating coils made by this company.

118. Plastics. American Cyanamid Co., New York, N. Y.—A new monthly booklet called "Plastics Salesfront" has been announced by this company. Its purpose is to promote a more intelligent use and sale of plastic products.

119. Materials Handling. Island Equipment Corp., New York, N. Y.—Bulletin HP-6, contains four pages describing the conveyor belt made by this company.

120. Safety Equipment. Chicago Eye Shield Co., Chicago, Ill.—64-page catalog illustrating and describing the safety equipment made by this company. Includes information on how to use, maintain, and select industrial protective equipment. 15 pages are devoted to correct safety procedures.

121. Disinfectants. Sindar Corp., New York, N. Y.—Bulletin 48-4, 4-page folder describing the chemical, physical and bacteriological properties of Compound G-4 (5-chloro-2-hydroxy phenyl) methane.

122. Electric Motors. Allis-Chalmers Mfg. Co., Milwaukee, Wis.—12-page bulletin No. 51B6052J entitled "Handy Guide for Quick Selection of Electric Motors."

123. Organic Chemicals. Carbide and Carbon Chemicals Corp., New York, N. Y. —Form 6136. 12-page booklet entitled "Physical Properties of Synthetic Organic Chemicals." This is a new and revised edition containing data on applications and physical properties for more than 185 synthetic organic chemicals.

124. Process Equipment. The Darby Corp., Kansas City, Kan.—Four leaflets describing and illustrating the process equipment manufactured by this company. The first of these contains four pages showing fabricated equipment of various kinds. The second features vari-

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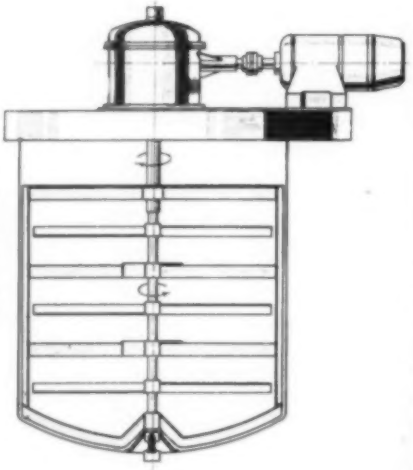
Write for information.



New England Tank & Tower Co.

EVERETT 49, MASS.

ous types of forgings from steel, alloys and aluminum. The third of these is a two page leaflet describing corrosion resistant equipment, also a list of the types of equipment manufactured and the services available from this company.

125. Safety Equipment. Safety Engineering Div., American Optical Co., South Bridge, Mass.—A new chart suggesting the proper respiratory protection against more than 150 specific dusts, vapors and gases is now available from this company.

126. Spray Nozzles. Spraying Systems Co., Chicago, Ill.—Catalog No. 23. 12-page booklet illustrating and describing the pneumatic atomizing spray nozzles made by this company. Each of the different types of spray nozzles are illustrated with cut-away views. Performance data is included.

127. Oscillographs. Allen B. DuMont Labs., Inc., Clifton, N. J.—New catalog illustrating and describing cathode-ray tubes, oscillographs, allied equipment and accessories manufactured by this company.

128. Pumps. Roy E. Roth Co., Rock Island, Ill.—4-page folder illustrating and describing the self-priming turbine type pump unit made by this company. Features of construction are illustrated in a schematic diagram.

129. Waste Treatment. National Lime Association, Washington, D. C.—32-page publication, Trade Waste Bulletin No. 1, entitled "The Use of Lime in Industrial Trade Waste Treatment."

130. Protective Coatings. Amercoat Div., American Pipe and Construction Co., Los Angeles, Calif.—4-page leaflet, No. CHB48, describes the use of this company's protective coatings in the chemical industry. Contains two pages of tables giving coating recommendations to prevent corrosion and contamination in different phases and different branches of the chemical industry. Lists a large number of chemical solutions which can be successfully handled and equipment protected by the coating described.

131. Conveyors. Harry J. Ferguson Co., Jenkintown, Pa.—4-page folder describing and illustrating the aluminum gravity conveyors made by this company.

132. Rubber Matting. B. F. Goodrich Co., Akron, Ohio—Catalog Section 6100. 4-page catalog gives detailed description of the various types of rubber mats and matting now available.

133. Electric Motors. Electric Machinery & Mfg. Co., Minneapolis, Minn.—20-page booklet No. 24 pictures and describes the electric motors and equipment used in the process industries.

134. Plastics. Bakelite Corp., New York, N. Y.—38-page brochure describing vinylite resins and plastics. Includes information on types of resins, applications, and properties.

135. Stainless Steel. Allegheny Ludlum Steel Corp., Pittsburgh, Pa.—36-page booklet entitled "Allegheny Metal in Chemical Processing." Application of stainless steel in the various branches of the chemical processing industry are illustrated and described.

136. Steam Turbines. Worthington Pump & Mfg. Co., Harrison, N. J.—Bulletin No. 1961 contains 28 pages describing the multi-stage steam turbines. Features of construction are illustrated, as well as are the number of typical installations.

137. Materials Handling. Clark Equipment Co., Battle Creek, Mich.—4-page illustrated folder describing gas and electric industrial trucks.

138. Instruments. Northern Equipment Co., Erie, Pa.—Bulletin 483 is a 4-page folder giving the case history of boiler feed water control using this company's equipment.

139. Crushers. The Jeffrey Mfg. Co., Columbus, Ohio—Bulletin No. 811 contains 4 pages featuring the "Mud Hog" crushers made by this company. Specifications are included and many details of construction are illustrated.

140. Rack Rake. Newport News Shipbuilding & Drydock Co., Newport News, Va.—16-page booklet illustrating and de-

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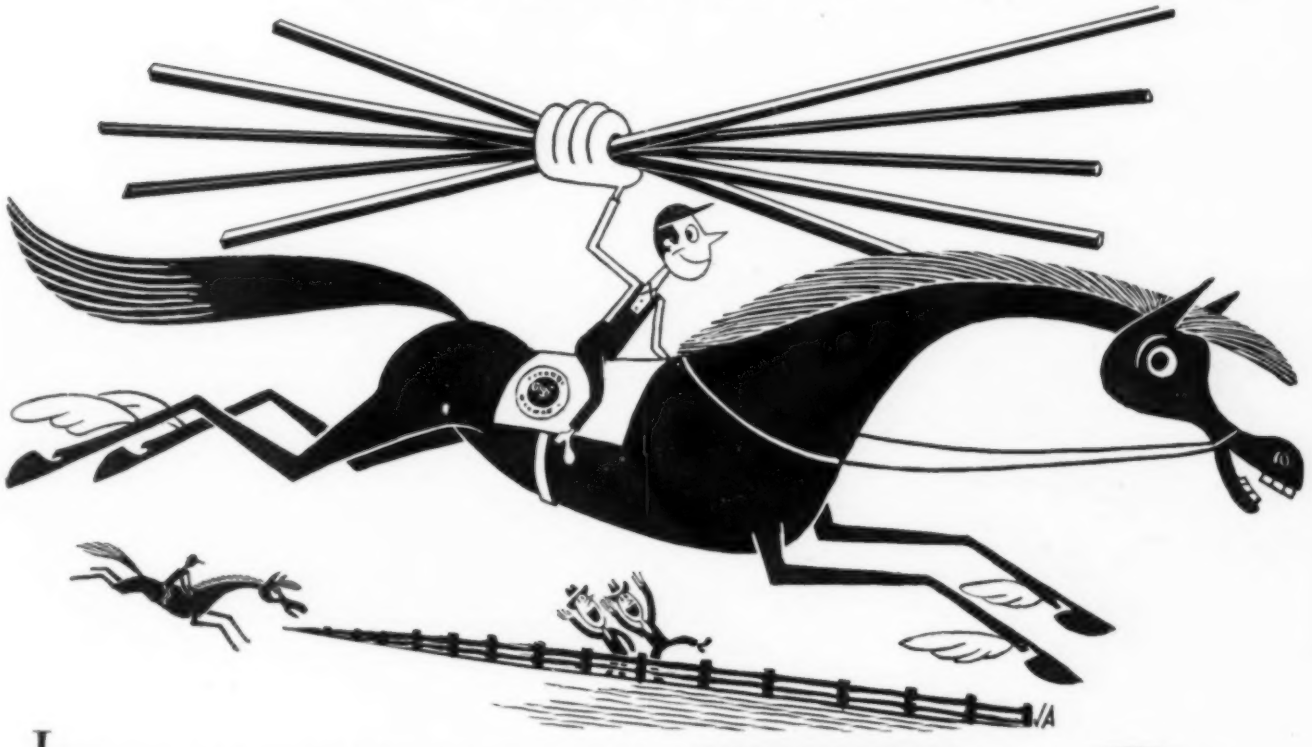

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See Reader Service Coupon on pages 175–176

scribing the mechanically operated rakes for cleaning rack bars of trash such as leaves, grass, sticks, bark and logs. Contains diagrams of typical installation arrangements.

141. Conveyors. Robins Conveyor Div., Hewitt-Robins, Inc., Passaic, N. J.—Bulletin No. 125-A. 4-page folder illustrating the general line of conveyor equipment made by this company.

142. Pumps. Deming Co., Salem, Ohio—Pocket size folder illustrating the various types of pumps made by this company.

143. Lubrication Equipment. The Farval Corp., Cleveland, Ohio—Bulletin No. 25. 14-page illustrated booklet describing the centralized systems of lubrication equipment made by this company. Lubrication pumps and accessories are illustrated and described.

144. Dehydrating Systems. The Heil Co., Milwaukee, Wis.—8-page folder featuring the Ardrier dehydrating system made by this company.

145. Research. National Research Corp., Cambridge, Mass.—16-page illustrated brochure showing applications of equipment designed and built by this company. Describes the services available from this company.

146. Speed Control. Reeves Pulley Co., Columbus, Ind.—12-page booklet describing the speed control equipment made by this company, its applications, operating principles and advantages.

147. Chemicals. Smith-New York Co. Inc., Freeport, L. I., N. Y.—27-page monograph describing citraconic anhydride. Gives chemical and physical properties together with information on specific reactions and derivatives.

148. Silicones. General Electric Co., Pittsfield, Mass. — 30-page illustrated booklet, No. CDR-57 describing in detail the silcone products made by this company.

149. Heater. Thermobloc Div., of the Prat-Daniel Corp., East Port Chester, Pa.—8-page bulletin No. 300 describes the new direct-fired unit heater made by this company.

150. Glass Thermometers. Wm. Hiergesell & Sons, New York, N. Y.—4-page booklet describing the etched scale thermometer made by this company. Bulletin No. 208.

151. Chemicals. General Electric Co., Pittsfield, Mass.—20-page booklet describing briefly the chemical products made by this company. Bulletin No. CDP-576.

152. Instruments. Brooks Rotameter Co., Lansdale, Pa.—Complete catalog illustrating and describing the line of rotameters for flow rate measurement and control manufactured by this company. Includes specifications, together with detail drawings and dimensions.

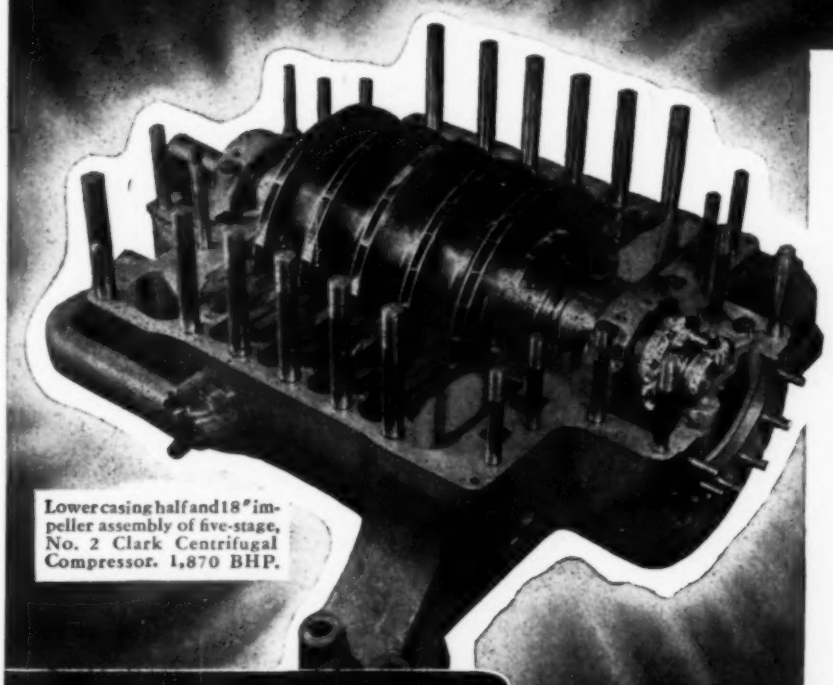
153. Chlordane. Julius Hyman & Co., Denver, Colo.—Eight pages of mimeographed releases summarizing recent results from the use of chlordane on various pests and crops. Includes a list of chlordane formulators with location.

154. Densitometer. Applied Research Laboratories, Glendale, Calif.—A 4-page folder on this firm's film comparator densitometer. Gives specifications, advantages, design features and method of operation.

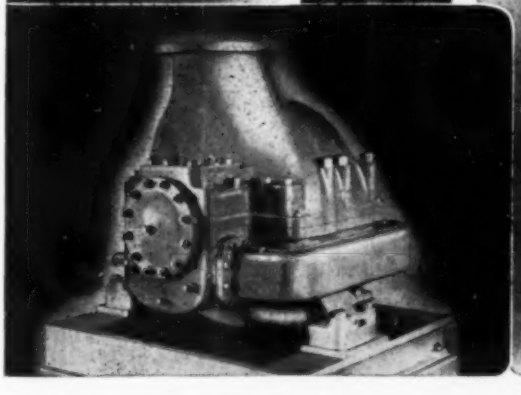
155. Equipment. Denver Equipment Co., Denver—Eight-page illustrated folder listing the new and used equipment items which this company now has for quick delivery. Items range from agitators to pumps to thickeners.

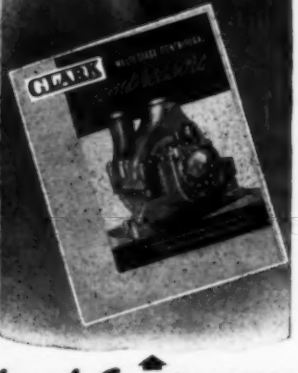
CLARK CENTRIFUGAL COMPRESSORS

for large tonnage PROPANE REFRIGERATION



Lower casing half and 18" impeller assembly of five-stage, No. 2 Clark Centrifugal Compressor. 1,870 BHP.





For the MEK Solvent Dewaxing Process in manufacturing lube oils, Clark is building seven Propane Centrifugal Refrigeration units to operate at approximately —20° Fahrenheit. Other Clark Propane Multi-Stage Centrifugal Compressors will operate at a higher temperature to cool absorber oil.

Clark's Multi-Stage Centrifugal Compressors, designed for use with Propane and other hydro-carbons as refrigerants, are particularly suitable for high pressures and large volumes. They can compress capacities from 2,000 to 120,000 c.f.m. with discharge pressures up to 475 lbs. With the Clark multi-stage design, two or more compressors can be connected in line with one driver for through drive, thus saving floor space, also installation and operating costs. They can be driven either with a directly connected turbine or a motor through a speed-increasing gear.

Clark's Multi-Stage Centrifugal Compressors can be arranged quickly and easily to meet any desired pressure or capacity within the ranges stated above. Standardized design permits use of interchangeable parts and easy adaptation to different types of service, as well as speed in filling orders. Write for full information.

CLARK BROS. CO., INC. • OLEAN, NEW YORK

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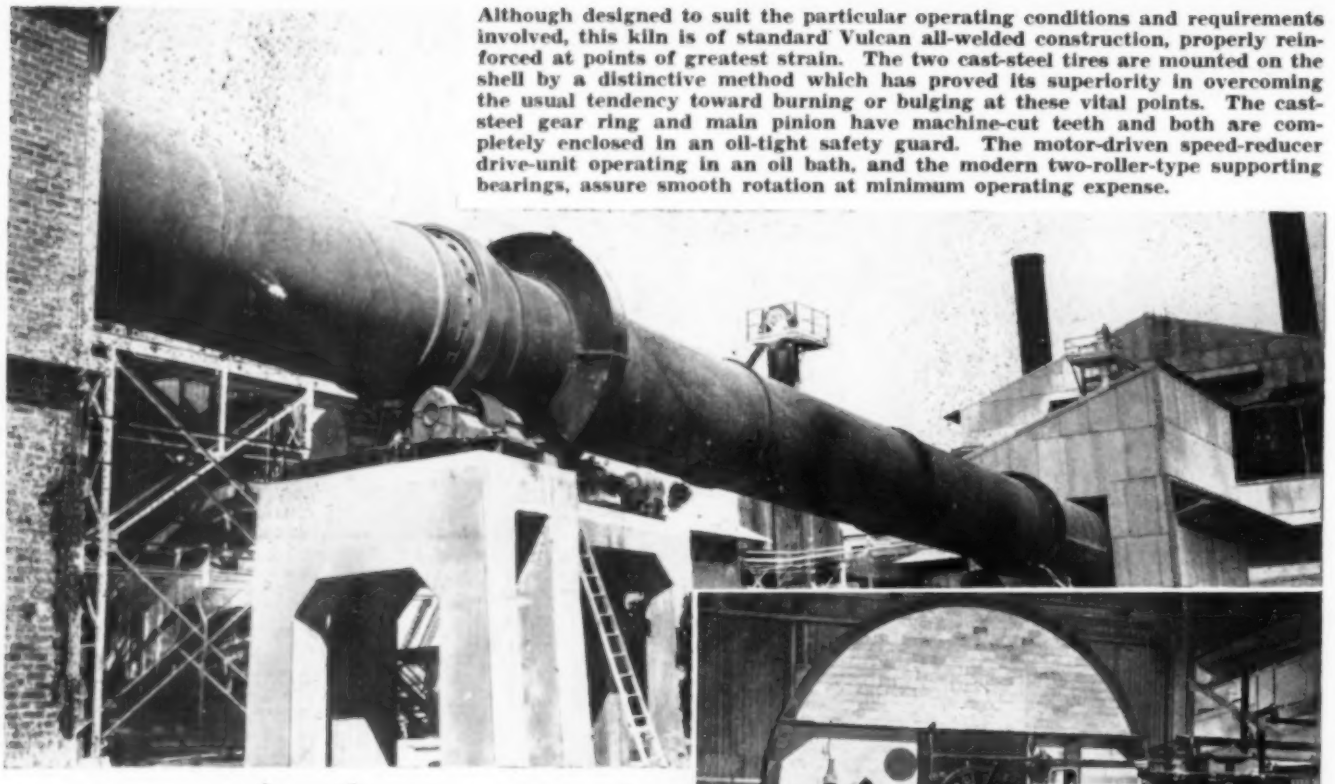
Write for Bulletin on Centrifugal Compressors—

CLARK

ONE OF THE DRESSER INDUSTRIES

SETS THE PACE IN COMPRESSOR PROGRESS



Although designed to suit the particular operating conditions and requirements involved, this kiln is of standard Vulcan all-welded construction, properly reinforced at points of greatest strain. The two cast-steel tires are mounted on the shell by a distinctive method which has proved its superiority in overcoming the usual tendency toward burning or bulging at these vital points. The cast-steel gear ring and main pinion have machine-cut teeth and both are completely enclosed in an oil-tight safety guard. The motor-driven speed-reducer drive-unit operating in an oil bath, and the modern two-roller-type supporting bearings, assure smooth rotation at minimum operating expense.

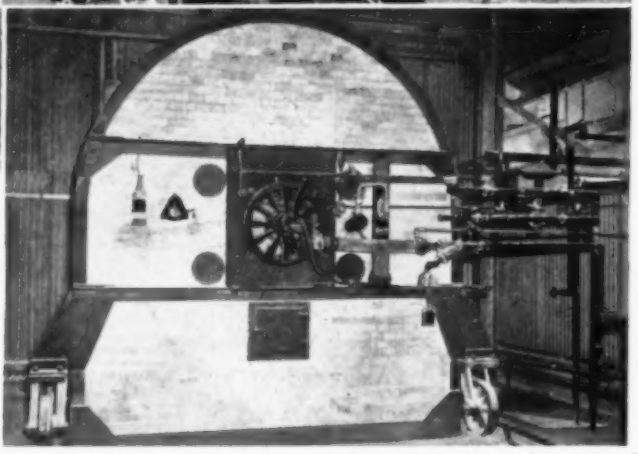
Another
VULCAN ROTARY KILN
in a modern paper mill

Recovery of lime from paper-mill sludge is only one of many ways in which Vulcan Rotary Kilns, Coolers, Dryers, Retorts, Pelletizers, etc., are cutting costs for the chemical processing, metallurgical and rock products industries.

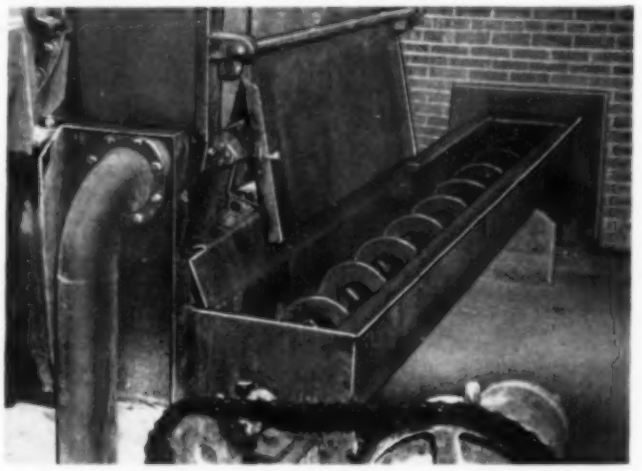
Materials and processes to which Vulcan equipment is now being applied include the nodulizing and pelletizing of fine wet ore, desulphurizing of ore, dehydration of bauxite and many other minerals, alteration of barytes, calcining of lithopone, calcining of titanium dioxide, etc. In practically all cases these various types of rotary cylinders are designed especially to meet the purchaser's requirements and our engineers always welcome opportunities to make helpful suggestions—based upon data accumulated during more than fifty years of successful experience.

Bulletin 442-C Tells More

—not about processing methods, because that would require a thick volume, but its 28 fully-illustrated pages are packed with specific information regarding Vulcan Rotary Kilns, Coolers, Dryers, Briquetting Machines and other processing equipment. We want every engineering and productive executive who can use this booklet to advantage to have a free copy and will mail it promptly on request.



The firing hood is one of a number of modern Vulcan designs—modified, in this case, for the burning of natural gas. In this design the entire firing hood is mounted on wheels but we also offer stationary firing hoods and a variety of special features to meet specific requirements.



The sludge feeder is our latest ribbon screw-conveyor type, suitable for handling wet or moist materials, and projects through the stack chamber into the kiln—the section exposed to high temperature being water-cooled. Various other methods are employed for feeding material into Vulcan kilns, dryers, retorts, etc., according to operating conditions and requirements.

Vulcan Iron Works, Wilkes-Barre, Pa.

Other Vulcan Products include Industrial Locomotives, Electric Hoists, Mining Machinery, Sugar-Mill Machinery, Heavy Special Machinery

CHEMICAL ECONOMICS

Richard F. Warren, ASSISTANT EDITOR

Outlook for Record Chemical Operations Is Good as Third Quarter Ends

OUTPUT of the chemical process industries will be about $30 billion this year according to latest available data. Plant expansion to meet new demands has made good progress. Most of the inflated demand caused by wartime shortages has been eliminated. In fact, optimism on the part of the chemical industry is reflected by the large industrial expansion and research programs now under way. Even established heavy chemical companies such as Solvay are now erecting large new research facilities.

One of the results of the chemical industry's postwar expansion has been an increase in the trend to migrate to the Southwest and Far West—away from the eastern seaboard. In the past few years almost all of the larger companies have been attracted to these regions by lower power and fuel costs. More than $1 billion has been spent by the chemical industry for new plant facilities in the Southwest during recent years. In the Far West cheap hydroelectric power has brought several chemical concerns to the area.

Chemical Markets

In view of the optimism on the part of the chemical industry, it is interesting to look at the markets for chemicals to find the source of such an attitude. Outside of the chemical industry itself, chemicals are consumed in the soap, paint, fertilizer, pulp and paper, glass, rayon, textile, coal products, explosives, rubber, leather, and plastics industries.

Fastest growing chemical process industry is plastics. It has grown 124 percent since 1941 according to industry spokesmen. Synthetic resin capacities will be increased about 50 percent when current expansions are completed this year.

Fertilizer industry flourishes in good crop years, and this year farmers have lots of money in their pockets. National Fertilizer Association expects to see an 8 percent rise over 1947 during this year. The industry has already increased its chemical requirements 83 percent compared with 1941 demand.

Rayon is still growing. Present production rates are above 90 million pounds per month and the trend is up. Chemical use in this industry has expanded 99 percent since 1941. Petroleum runs to stills were highest in history in the third quarter of this year and coming output of synthetic fuels, along with byproduct chemicals will swell chemical consumption in this part of the process industries. It has already raised its chemical requirements 41 percent in the past seven years. Natural rubber has bounced back and, along with its synthetic partners, it has increased its needs by more than a third when compared with prewar use. This excludes chemicals used to make the synthetics. Industrial explosives have also expanded their chemical requirements by one third in a corresponding period.

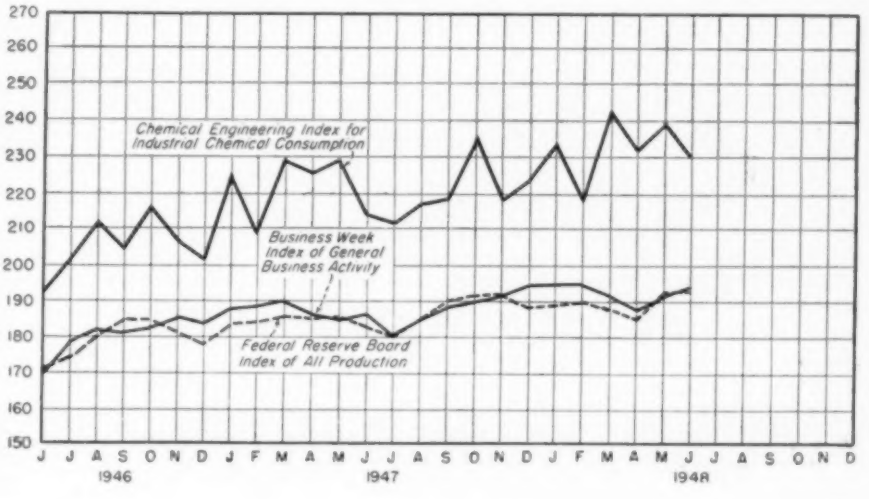
Chemical Engineering Index
Industrial Consumption of Chemicals
1935 = 100

	May (Revised)	June
Fertilizers	58.96	49.70
Pulp and paper	24.90	24.59
Petroleum refining	22.08	22.10
Glass	18.59	19.94
Paint and varnish	27.20	27.00
Iron and steel	13.89	13.35
Rayon	26.35	26.70
Textiles	11.15	11.10
Coal products	10.58	10.32
Leather	4.29	4.33
Industrial explosives	8.98	8.10
Rubber	5.20	5.63
Plastics	7.65	7.45
Index	239.82	229.86

Glass Industry

Glass industry is having its ups and downs. Glass containers were in a slump during the first half of the year and an Owens-Illinois Glass milk bottle plant at Columbus has been converted to production of glass construction blocks. Pittsburgh Corning's new block unit at Sedalia, Mo., will help expand this type of glass fabrication. Pulp and paper, coal products, iron and steel, soap, and textile industries have also shown a growth over the prewar period.

After considering conditions in the various consuming industries, it is estimated that volume of chemical production in 1948 will be about 5 percent above 1947 levels—provided normal peacetime conditions continue. All these figures add up to the fact that the chemical process industries this year will establish a new peak in both production and consumption of chemicals.



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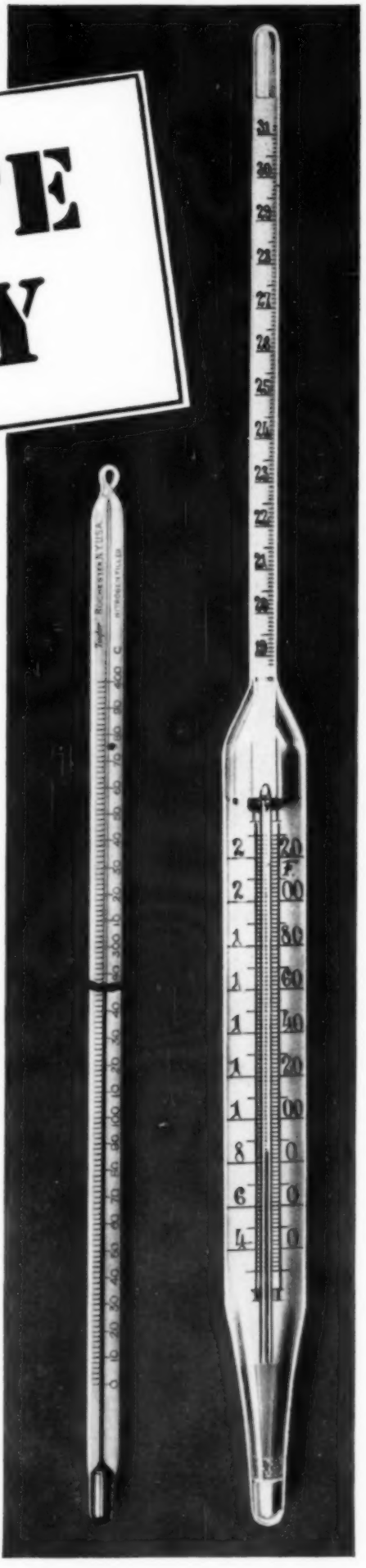

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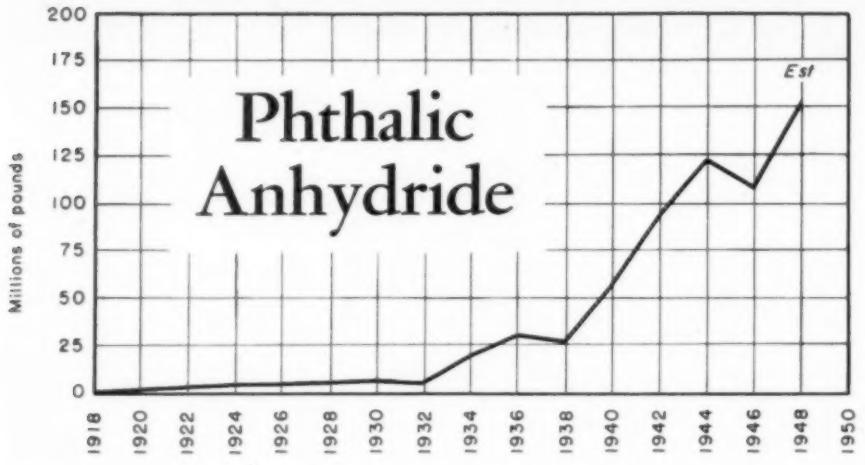


PRODUCTION will hit a new high this year.

Firm	Plant Location	Raw Material
American Cyanamid Co.	Bridgeville, Pa.	Naphthalene Ortho-xylene
Barrett Div., Allied Chemical & Dye Corp.	Frankford, Pa. Ironton, Ohio	Naphthalene Naphthalene
E.I. du Pont de Nemours & Co.	Deepwater Point, N. J.	Naphthalene
Monsanto Chemical Co.	St. Louis, Mo. Everett, Mass.	Naphthalene Naphthalene
National Aniline Div., Allied Chemical & Dye Corp.	Buffalo, N. Y.	Naphthalene
Pittsburgh Coke & Chemical Co.	Neville Island, Pa.	Naphthalene
Reichhold Chemicals, Inc.	Tuscaloosa, Ala. Detroit, Mich.	Naphthalene Naphthalene
Sherwin-Williams Co.	Kensington, Ill.	Naphthalene
Standard Oil of Calif. (Oronite Chemical Co.)	Richmond, Calif.	Ortho-xylene
Koppers Co., Inc.	Kobuta, Pa.	Naphthalene

PRODUCERS are expanding.

WE NEED more phthalic anhydride. We will get it. Producers are completing expansion programs this year that will raise U. S. capacities to 190-200 million pounds per year. This may satisfy our immediate needs, but in a few years we will probably return to a short supply situation.

This essential ingredient for alkyd resins is made from one of two raw materials—naphthalene or ortho-xylene. Nine producers depend on naphthalene to make their phthalic anhydride. Naphthalene comes from coke-oven tars and is scarce. According to experts, there are two ways to get more naphthalene: First is to process a higher percentage of coke-oven tar produced; and the second is to improve yields of naphthalene from processed tar. However, even these suggestions are limited by the total tar production.

John M. Weiss, at the recent AIChE Cleveland meeting, estimated the potential crude product in produced tar was about 40 million pounds above the potential naphthalene in processed tar. Since the steel industry is the principal source of coke-oven tar, the supply of this raw material depends on the demand for steel.

Ortho-xylene is used by American Cyanamid Co. and Oronite Chemical Co. Oronite is pushing this process and gets about 85 percent yields of phthalic anhydride from ortho-xylene produced from petroleum. Cyanamid uses both ortho-xylene and naphthalene to produce the largest supply of anhydride in the country. However, when Allied completes its expansions it will be larger. Ortho-xylene is produced from hydroformers in petroleum refineries. Standard of California's Richmond refinery supplies Oronite (its subsidiary) with this raw material. With crude naphthalene prices up to 6 c. per lb. (twice the prewar level), separation of the ortho-xylene should become more widely practiced. Expansion of this raw material depends on operations at hydroforming plants and the possible growth in uses for the meta and para isomers produced with the ortho.

Consumption of phthalic anhydride has grown rapidly since 1916, when discovery of a vapor-phase process for oxidation of naphthalene brought it into the industrial chemical class. At that time its principal use was in the manufacture of coal-tar dyes. Later production of dibutyl phthalate and other plasticizers put large demands on the growing output of this chemical. As alkyd resins grew, so did production of phthalic anhydride. Then the recent war pushed the insect-repellent end of the business to new heights. With the end of the war came a continuing growth in the alkyd resin industry and other branches of the plastics industry, but a large slump in insect repellents.

An interesting point about the phases in the growth of phthalic anhydride is that each new use has expanded production rather than eliminated an older field.

At the present time phthalic-ester plasticizers consume about 30-35 percent of the output. Alkyd resins use about 50-55 percent of the anhydride production. Both uses seem to have a bright future; no slump in demand is expected.

More than 140 million pounds of the anhydride were made in 1947. At current rates, about 150 million pounds will be produced this year. This is 20 percent greater than peak wartime output. Oronite is expanding its facilities and will increase its output at Richmond. This plant is the only western unit in the country, all of the others are close to raw material (naphthalene) sources in the Ohio, Pennsylvania, Michigan, and Illinois area. An exception is Monsanto—with units at St. Louis and Everett, Mass.

Prices have been going up in recent years and after a long period of decreasing prices (from 1916's $4.23 per lb. to 1932's 11c. per lb.) the wartime price was 14c. per lb. Today the price ranges from 19½ to 22½c. per lb. in carload quantities.

Imports of naphthalene have been low in the postwar period, but increases in the flow of this material from England are expected to occur this year. Naphthalene imports have not been up to expectations due to the widespread need for it in countries of origin.

Expansion of phthalic anhydride productive facilities by Barrett at Ironton, Ohio, and Pittsburgh Coke & Chemical Co. at Neville Island as well Oronite's expansion will give us an expansion in production by the end of 1948 that may be 3 million pounds per month above current levels. All expansions are being carried out by producers who make their own raw material. With this additional supply coming into the market, experts differ on the immediate effect on the demand. Some feel that it will be temporarily satisfied while others say that the need for phthalic in plasticizers and alkyd resins as well as dyestuffs may keep it in short supply. In any event, on a long term basis the supply of naphthalene will be inadequate to meet the growing needs of phthalic anhydride and other chemicals. Therefore petroleum's ortho-xylene will be called on to assume a larger share of the load in the future.

A *"Chem & Met"* Special Report on

Changing Price Systems

Here is the second of a series on the effect of recent developments in FTC rulings on delivered price systems.

MANY chemical producers who never did so before are now keeping a sharp eye on the Federal Trade Commission. They are looking for a tipoff as to how hard FTC will swing the Cement Institute Decision against delivered pricing in other industries.

One such tipoff came to light recently in an FTC case against National Lead Co., and a half dozen other producers of white lead and other pigments for paint manufacture.

In its brief on a trial examiner's recommended decision, FTC trial lawyers reiterated the idea that delivered pricing is illegal only if the commodity is: (1) standardized with little quality difference between the product of one seller and another and (2) so heavy that freight charges are an important part of the final cost of the product to the buyer.

Trial Briefs

Another point in the case involved the trial examiner's finding that, in this industry, there was no price discrimination against near-the-mill buyers when a producer charged one delivered price to all customers within a single zone.

Speaking of the scope of the Cement Institute decision, here's what the FTC lawyers wrote in their brief:

"Arguments will no doubt be advanced that (the Cement Institute decision) would necessarily result in condemning any universal delivered price system in any other industry, and would be . . . applicable not only to the heavy industrial products here but to chewing gum, candy, magazines, and a host of other common articles of commerce which are sold on a universal price. Such argument is without foundation."

In the lead pigment industry, said the FTC brief, systematic freight absorption and phantom freight involved in the zone delivered pricing system resulted in (1) no competition between the producers and (2) price discrimination against near-the-mill buyers.

However, says the brief, "Obviously there cannot be any serious injury to competition among either buyers or sellers if transportation charges bear no substantial relation to the price of the article sold."

Delivered pricing systems used by a large part of American industry already have been hit hard by two shocks—and doubt still surrounds some widely-used practices.

Court Actions

The first shock was a series of Supreme Court decisions that not only banned certain practices, but seemed to threaten many traditional pricing systems.

The second was the steel industry's abandonment of long-established basing points for an fob. mill pricing system. Some steel companies also revised byproduct chemical prices to an fob. basis. This move seemed to threaten the competitive position of many companies.

Together they raised two great questions for American industry: (1) Will a large part of America's industries—ranging from pulp and paper to road machinery, from liquefied gas to plywood—be forced to switch from delivered pricing systems to fob. mill pricing to conform to new legal benchmarks? (2) Will the switch to fob. pricing by benzene, toluene, and xylene, steel, cement, and other industries disrupt and dislocate competitive standings of producers or consumers?

To throw some light on these questions, the McGraw-Hill Department of Economics analyzed the economics of pricing methods in the steel industry. Then McGraw-Hill surveyed leaders of the steel industry, steel-using companies, economists and a wide range of companies whose pricing practices may be affected by the legal changes. Included were companies with multiple basing point plans, zone prices, freight equalization plans, and national uniform prices.

The surveys—three separate surveys were made on the major phases of the problem—showed the amount of concern aroused in business by the pricing developments. The surveys covered: (1) The economic effects of steel's switch to fob. pricing. (2) The specific effects of steel's switch on steel-using industries. (3) The reaction to legal developments among leaders in various industries that use delivered price systems.

Responses to the surveys showed a wide variety of interpretation of the pricing developments. The degree of concern shown by business leaders is shown in the fact that several of those surveyed—including the president of one of the industry's largest steel companies—wrote letters of several pages to make their views clear.

Briefly, the results show that there is a large area of uncertainty as to what will happen to delivered price systems. And the long-range effects of the changes in pricing practices that have been made, which may be important to the entire U. S. economy, are not entirely clear.

Short Range Effects

But one hard fact emerges: The immediate, short-run effects of the steel industry's change to fob. pricing are small, economically. That was the consensus expressed by steel industry leaders, important steel users, and economists who were surveyed by McGraw-Hill. They reviewed McGraw-Hill's analysis, checked their own experience, and in general, agreed.

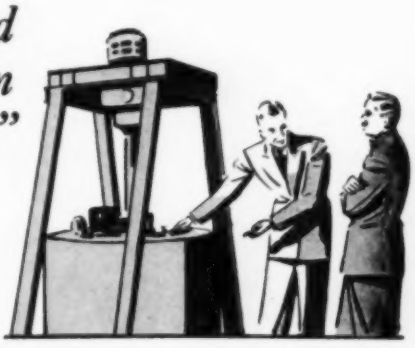
True, a few companies saw major effects immediately. But, in general, steel's going to fob. prices won't affect the competitive position of more than a small minority of steel users in the immediate future. Certainly, major markets and competitive positions of the vast majority of companies will not be revolutionized. There will be rare cases, of course, where a steel consumer pays extra freight and his luckier competitor does not, and where steel costs are a large part of the finished product's cost. There, competitive positions may be changed radically. But in only these rare cases will the pricing shift put a competitive disadvantage on steel consumers of over 1 to 2 percent in costs.

To get an accurate perspective on the reasons why the change has small effects in the short-run, we must take a look at three previous big changes in steel marketing methods.

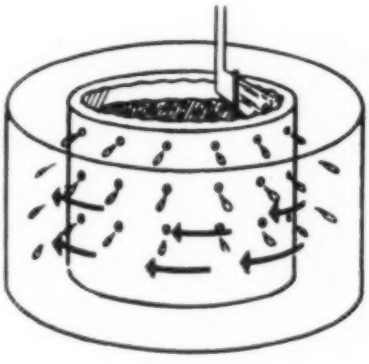
Before 1924, most of the industry

"My plant was stymied... every time we had to clean filters."

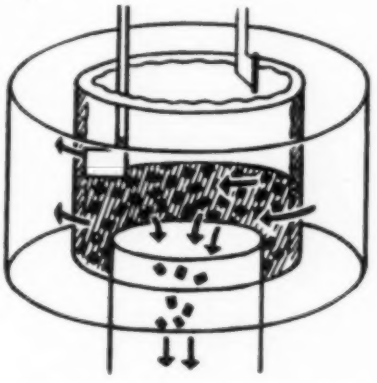
"This pigment manufacturer used filters to dehydrate his product. Every time pigment colors were changed, filters had to be cleaned . . . a laborious, expensive, time-consuming process which tied up production."



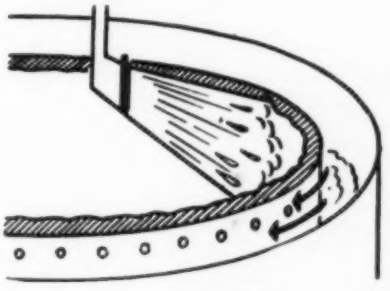
"An AT&M engineer solved the problem with a centrifugal having a perforate basket lined with a filtering element."



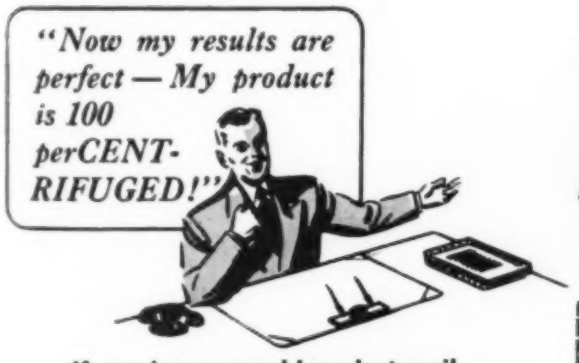
"The moisture is forced through the filter as the basket spins . . ."



". . . and the pigment plowed out, properly filtered and perfectly dry."



"Cleaning the filtering element is simple and fast, with production unaffected. Centrifuging also resulted in larger batches of pigment being processed with greater speed . . . with rapid change-over from one color to another.



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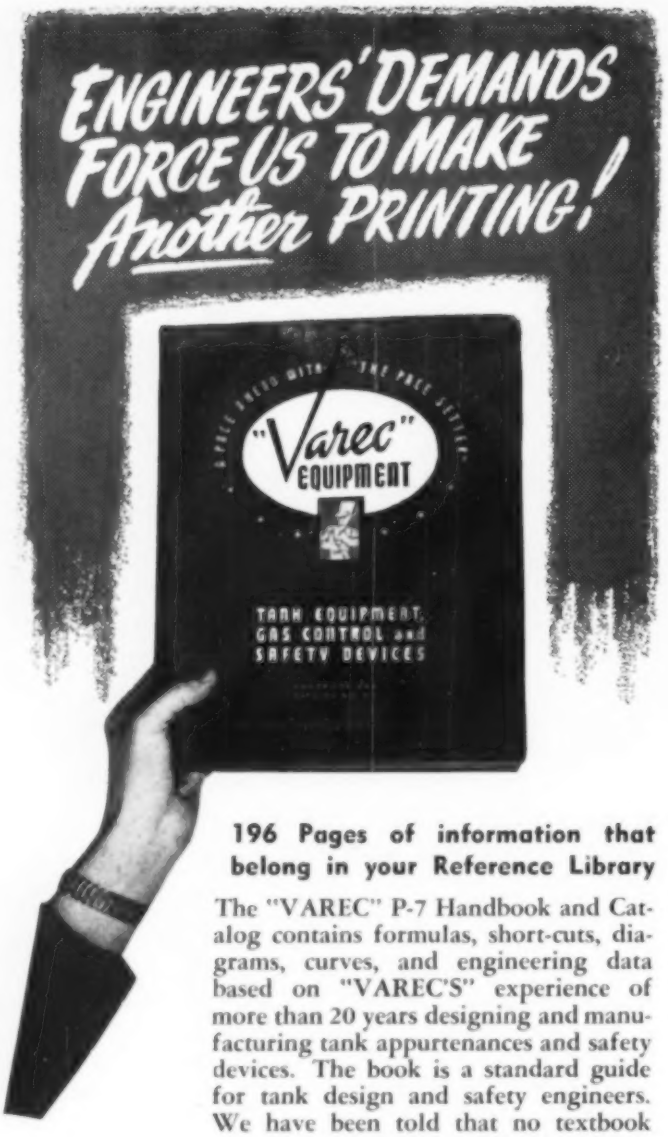

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sold on a "Pittsburgh plus" basis, a single basing point system. No matter where you bought steel, you paid the Pittsburgh mill price, plus freight cost from Pittsburgh. This was true even if you were in Milwaukee and bought steel from nearby Chicago. Under FTC pressure, the industry changed its practice in 1924 and began to use several basing points, such as Chicago and Birmingham. Consumers near those points benefited.

The second change came in 1938 when steel companies set up new basing points at many mills and started to price steel the same at most mills. Thus, the 1938 move was another stage toward fob. pricing. But this change did not eliminate the basing point system. Different mills could still compete in various markets—by meeting the "base" mill's delivered prices and absorbing any extra freight charges. For example, a Pittsburgh mill could sell in New York at the same delivered price as the Sparrows Point mill, by absorbing the extra freight. A great deal of this sort of competition went on before the war with one mill supplying a customer in another mill's natural market.

Last change in steel marketing came about during and after the war when demand ran ahead of supply. Mills abandoned most of their shipments into others' territories and concentrated on supplying customers close to them. Result was that most mills were selling mainly in their natural markets at mill price plus freight.

Market Dislocations

There were some shipments outside natural markets chiefly because local markets and supplies are not balanced. The Pittsburgh-Youngstown district—including western Pennsylvania, eastern Ohio, and northern West Virginia and Kentucky—has 40 percent of U. S. ingot steel capacity. It does not consume that much steel. Contrariwise, Detroit auto plants use more steel than is made in Detroit; the same is true of the Atlantic seaboard. So the Pittsburgh-Youngstown supplies went west and east into other basing point markets.

So, when the steel industry shifted to fob. pricing, the price that customers paid on the great bulk of the steel they bought was not affected. Most customers just went on paying what they had been paying—the mill price, plus the freight from the mill nearest them.

And even the great majority of the users buying the 10 percent to 15 percent of steel on which the pricing shift raised their costs will not have

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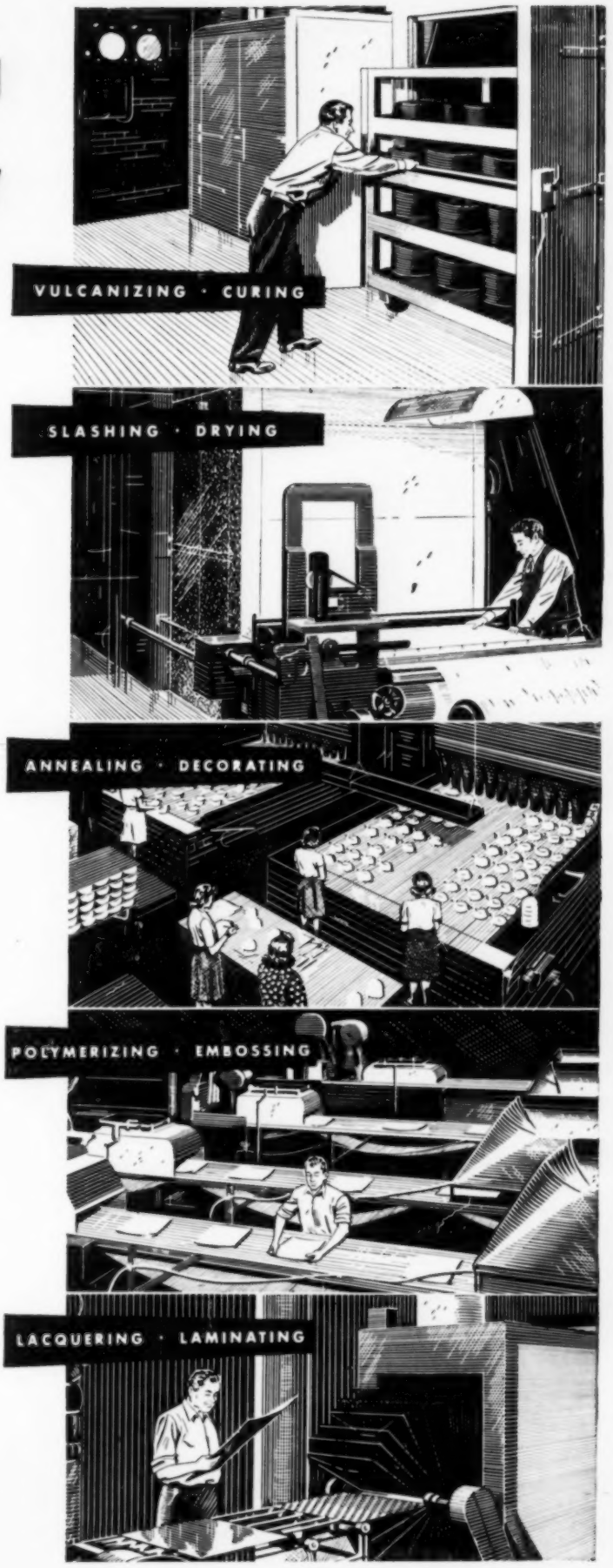

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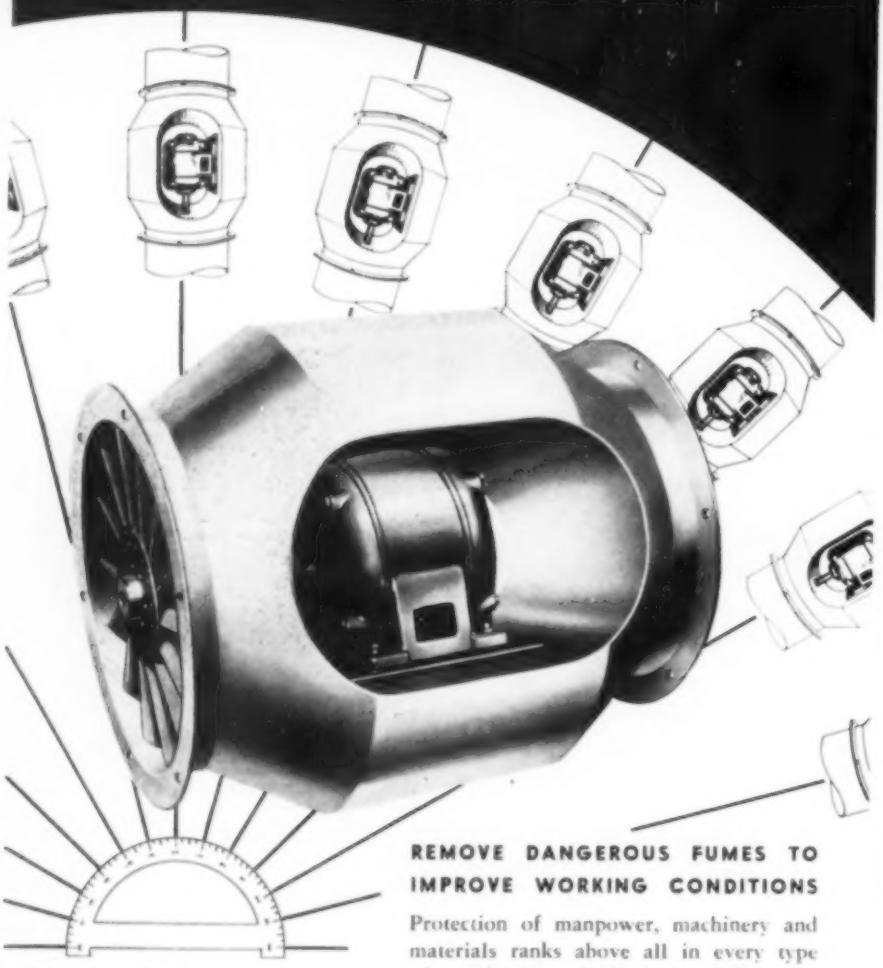

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their competitive position affected. Much of this steel went to Detroit where most automakers are located. And even though the auto companies' practices in buying steel varied, they were affected in much the same way by the pricing shift. Furthermore, the cost of steel in itself is only 10 to 12 percent of factory sales prices, so the shifts among the auto companies in competitive positions are minor.

Here is one of the major sources of confusion coming from the pricing switch. The New York or California steel user has always had higher steel costs than did his Pittsburgh competitor. He was further from the mill. The change to fob. pricing did not cause the differential; at most it increased it only slightly.

What may happen in the long-run, must be conditioned by legal decisions that are not yet made. This is true not only of steel, which makes a prime example for considering the effects of new ways in pricing, but for all other industries.

Results of Survey

Even the trend of legal decisions is not yet clear. But McGraw-Hill's surveys of business' reaction to the recent series of cases, and the opinion of the Federal Trade Commission's experts, stress certain basic points.

The first is the FTC's major concern to eliminate practices that restrict competition. The second is that it has two basic approaches. They were used—one, or the other, or both—in the recent important price cases. They are: (1) Is there "collusion"—a conspiracy to fix prices and so restrict competition? (2) Is there "discrimination" in the pricing system that works an injury to competition—either among sellers or their customers?

Of course, the facts of the matter are all important. For that reason FTC experts say that a businessman is the best judge of his own pricing system. Beyond the question of facts, though, is a large shadow-land of legal points. And there is room for substantial disagreement among even lawyers as to the meaning and implications of the series of recent decisions on pricing cases.

FTC, however, has already cleared up some points. Its lawyers stress the point that no pricing system in itself has been declared illegal. A pricing system is questionable only if it contains elements of collusion or discrimination. The lawyers have said, too, that competition is not injured to a degree in uniform cost, or where the product is not standardized between brands or mills.

But there is not even unanimous

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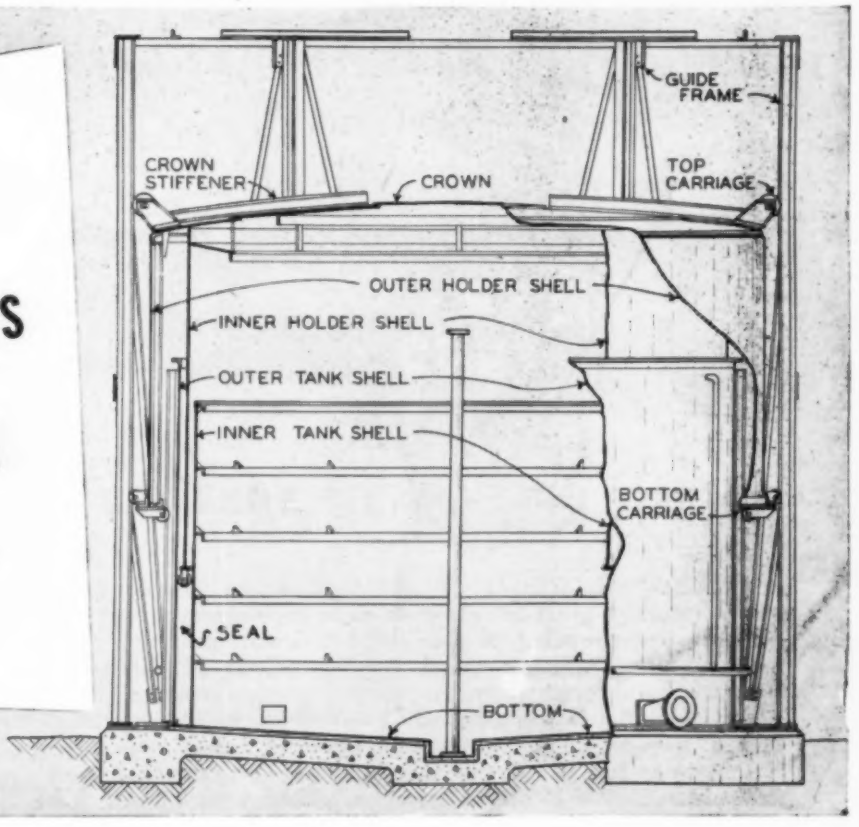

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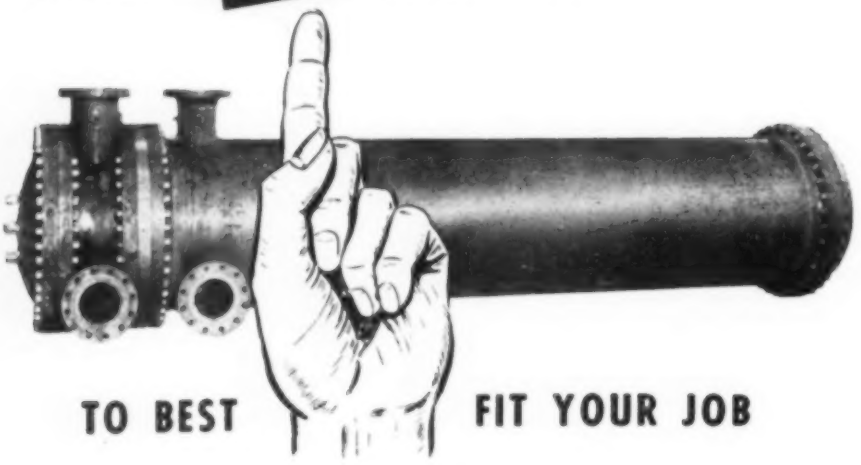

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5. Cost Economies

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agreement among the members of the FTC as to the meaning of recent decisions. Commissioner Lowell B. Mason, for example, said in a recent speech at the Harvard School of Business Administration, that, in his opinion, recent court decisions mean in effect that (1) Basing point pricing systems are out. (2) Zone prices are out. (3) Any individual "postage-stamp" price system is out.

Lawyers for industry, too, point out that continued extension of FTC ideas by the courts, as in recent cases, might well have the results foreseen by Commissioner Mason.

Outlook Muddled

In any case, there is still a wide area of uncertainty. A lot of clarifying must be done before all the confusion surrounding the status of some pricing practices is cut away. Certainly business needs expert advice in determining how some delivered price systems stand legally. Congress, too, may have a hand in determining the future. The 1949 Congress will hear a report from its Capehart Investigating Committee that may result in amendments to the FTC Act and the Clayton Act to limit the effects of the sweeping decisions concerning delivered prices.

McGraw-Hill's series of surveys of business reaction to developments in pricing show mixed results. Many companies recognize the possibility that their pricing systems may be affected, but they are awaiting clarification of the situation before they change. Leading companies in the chemical, pulp, glass, sugar, and electrical industries are among these. A few companies have changed, or will change their pricing systems as a result of the court decisions. Other companies—many of them—are not affected because they have been using fob. pricing for some time.

Economic factors, too, are major contributors to industry's shift to new ways in pricing. Merchant pig iron producers, for example, switched to fob. even before the court announced its decision in the cement case. Many chemical companies, faced with rising costs, have begun to charge freight to their customers, rather than absorb it, in order to avoid general price increases.

Other chemical firms are holding up some expansion programs. Recent changes to fob. systems was one of the reasons for cancellation of Stanolind's synthetic fuel plant at Garden City, Kan.

As other developments occur as a result of congressional action or court rulings, *Chemical Engineering* will add to this series of special reports the first of which appeared in July.

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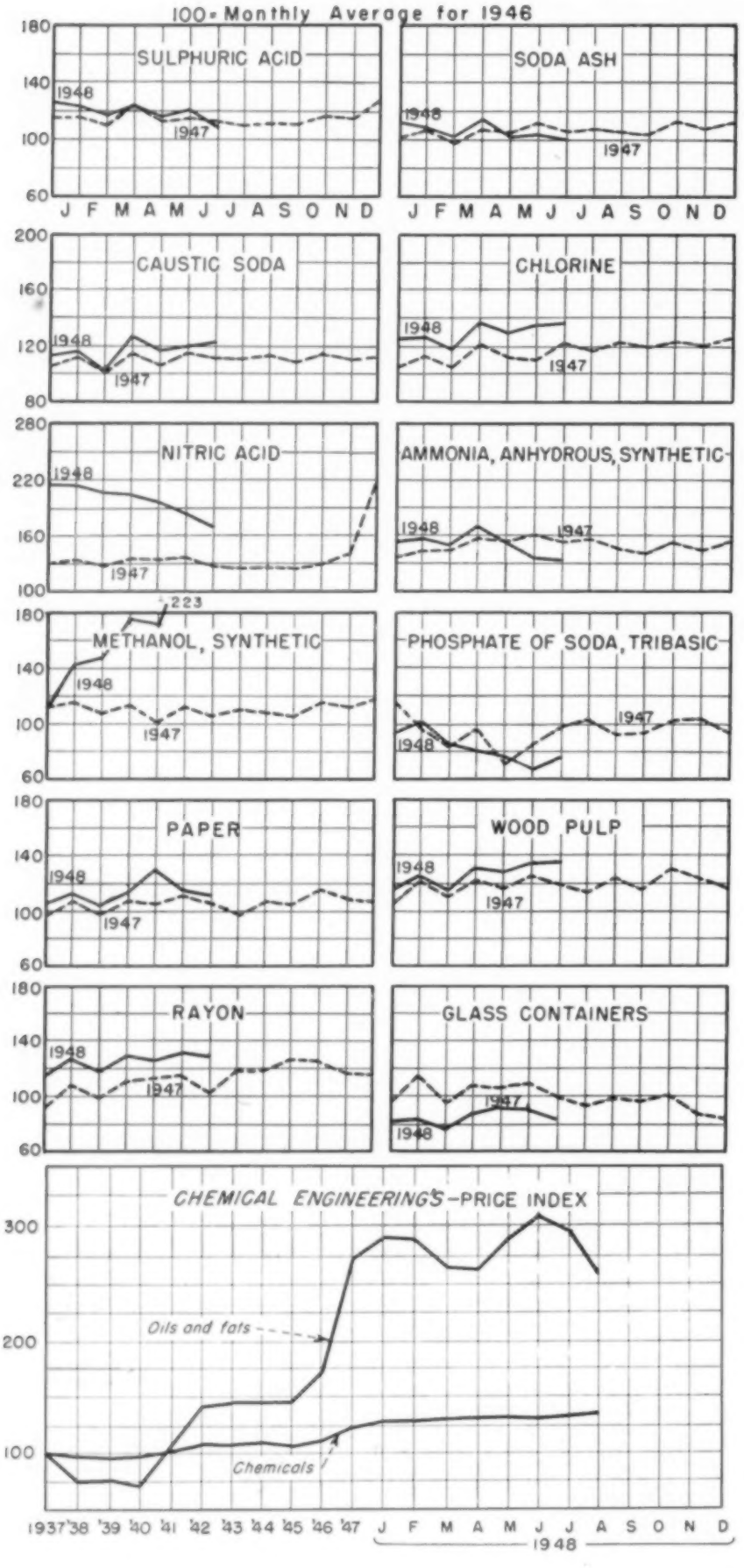
PRODUCTION, CONSUMPTION AND PRICE TRENDS



PRODUCTION of inorganic chemicals continued at a high rate in June, but dropped below May levels. However, chemicals such as chlorine and caustic soda hit new output peaks. Others followed the seasonal pattern and dropped off slightly.

Rayon production in the second quarter reached new record levels. July shipments reached 94.9 million pounds. This was 2 percent above June and 17 percent above July 1947 rates. In the first seven months of this year, consumption of rayon was 632 million pounds. Total 1947 consumption was only 533 million pounds. Stocks at producers were 13.4 million pounds at the end of July compared with 13.5 million pounds at the end of June.

Glass containers production dropped off in June to 8,145,000 gross, this is almost 8 percent below May output. Deliveries of soap in the second quarter were down slightly. Liquid soap consumption was off about 6.2 percent in the first half of 1948 compared with the same 1947 period. Consumption of other soaps in the first half was off 2.8 percent from levels reached in the first six months of 1947. Synthetic detergent sales reached 96.8 million pounds in the April-June period. This was 40 percent above the January-March rate of 69.0 million pounds, according to data prepared by the Association of American Soap and Glycerine Producers last month.

Price Trends

Price trend was down in August according to *Chemical Engineering*'s price indexes. In the last part of the month, prices began to harden. However, the reversal was not sufficient to bring the index up to last month's levels. Ethyl alcohol fell off sharply. Some authorities feel that current prices are unstable. The outlook is bearish. As a result, they feel that SD 1. may drop to 35c. by next summer.

Chemical Engineering

WEIGHTED INDEXES OF PRICES

Base = 100 for 1937

	Chemicals	Oils & Fats
As of September 1	132.22	251.67
Last Month.....	133.04	261.23
September 1947..	123.51	200.79
September 1946..	111.36	152.23

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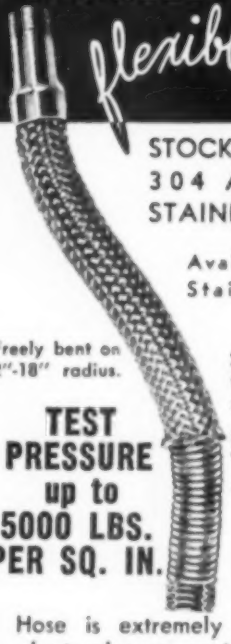

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United States Production of Certain Inorganic Chemicals

June 1948, June 1947, and Six-Month Totals for 1948 and 1947

Chemical (Tons unless noted)	June 1948	June 1947	Total, Six Months 1948	1947
Ammonia, synthetic, anhydrous[1]	81,364	91,681	542,509	548,438
Ammonium nitrate	70,299	85,655	505,708	526,593
Ammonium sulphate, synthetic (M lb.)	29,134	33,602	182,978	189,841
Calcium arsenate (M lb.)	5,488	8,859	20,612	21,200
Calcium carbide, commercial	54,585	48,136	344,819	315,704
Calcium phosphate:				
Monobasic (M lb.)	5,714	4,253	34,997	33,999
Dibasic (M lb.)	5,933	7,304	37,629	37,196
Carbon dioxide:				
Liquid and gas (M lb.)	21,388	22,987	116,002	110,352
Solid (M lb.)	82,462	73,713	353,344	337,028
Chlorine	133,231	124,067	763,279	685,697
Chrome green (M lb.)	935	1,147	6,403	7,994
Chrome yellow and orange, (C.P.) (M lb.)	4,306	4,534	25,871	23,718
Hydrochloric acid	34,930	33,196	219,190	210,902
Hydrogen (M cu. ft.)	2,207,000	1,697,000	13,335,000	9,754,000
Lead arsenate, acid and basic (M lb.)	2,097	1,436	19,618	23,695
Molybdate chrome orange, (C.P.) (M lb.)	590	305	3,128	2,332
Nitric acid	81,888	97,149	567,703	454,071
Oxygen (M cu. ft.)	1,288,000	1,089,000	7,910,000	6,752,000
Phosphoric acid (50% H_3PO_4)	95,589	89,492	583,173	496,887
Soda ash:				
Ammonia-soda process:				
Total wet and dry[2]	347,656	374,083	2,213,961	2,253,188
Finished light[2]	178,862	180,393	833,963	992,792
Finished dense	111,130	137,464	739,660	818,277
Natural[3]	26,837	22,898	148,252	129,157
Sodium bicarbonate, refined	11,868	14,147	69,910	95,771
Sodium bichromate and chromate	7,916	7,426	46,803	42,051
Sodium hydroxide:				
Electrolytic process:				
Liquid[3]	130,496	119,530	742,620	661,587
Solid	23,097	18,883	137,951	104,927
Lime-soda process:				
Liquid[3]	60,080	61,670	375,660	379,563
Solid	18,177	20,640	119,498	121,895
Sodium phosphate:				
Monobasic	886	1,291	4,818	7,169
Dibasic	6,457	6,838	40,430	38,815
Tribasic	6,032	7,855	38,881	42,099
Meta	2,716	3,109	17,314	14,547
Tetra	4,919	5,096	31,338	25,542
Sodium silicate, anhydrous	39,093	32,814	247,775	240,742
Sodium sulphate:				
Anhydrous, refined	13,263	11,454	80,709	69,595
Glauber's salt[4]	15,029	15,435	96,705	92,738
Salt cake, crude, commercial[4]	50,573	53,997	317,530	300,685
Sulphuric acid:[5, 7]				
Chamber process	223,878	264,556	1,583,969	1,692,253
Contact process, new	619,444	591,573	3,608,572	3,340,199
Zinc yellow, (zinc chromate) (C.P.)	571	279	2,284	1,502

Data for this tabulation have been taken from "Facts for Industry" series issued by Bureau of the Census. Production figures represent primary production and do not include purchased or transferred materials. Quantities produced by government-owned arsenals, ordnance works, and certain plants operated for the government by private industry are not included. Chemicals manufactured by TVA, however, are included. All tons are 2,000 lb. Where no figures are given data are either confidential or not yet available. [1]Includes a small amount af aqua ammonia. [2]Total wet and dry production, including quantities diverted for manufacture of caustic soda and sodium bicarbonate, and quantities processed to finished light and finished dense. [3]Not including quantities converted to finished dense. [4]Data collected in cooperation with the Bureau of Mines. [5]Figures represent total production of liquid materials, including quantities evaporated to solid caustic and reported as such. [6]Includes oleum grades, excludes fuming acid. [7]Data for sulphuric acid manufactured as a byproduct of smelting operations are included.

United States Production of Synthetic Organic Chemicals

May 1948, May 1947 and Five-Month Totals for 1948 and 1947

	May 1948	May 1947	Total, Five Months 1948	1947
Acetanilid	170,791	690,278	.....	3,484,197
Acetic acid:				
Synthetic[1]	37,144,452	31,761,083	166,307,084	153,318,879
Recovered	141,818,853	128,376,120	691,483,812	608,860,682
Natural[2]	1,946,262	2,114,587	10,445,257	10,373,456
Acetic anhydride[3]	63,937,016	54,248,626	309,772,304	256,360,350
Acetone	42,127,687	31,777,958	190,659,942	150,169,276

(Continued on page 356)

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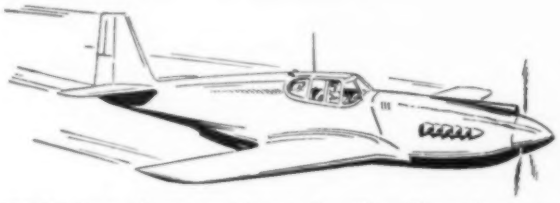

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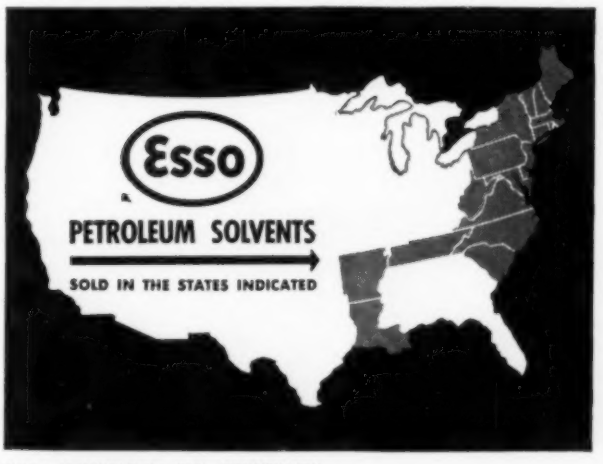

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U. S. Production of Synthetic Organic Chemicals (Cont. from page 354)

	May 1948	May 1947	Total, Five Months 1948	Total, Five Months 1947
Acetylsalicylic acid	559,376	1,052,519	3,638,066	4,876,125
Aniline	7,838,405	9,377,617	43,209,863	45,331,674
5-Ethyl-5-phenylbarbituric acid and salts (phenobarbital)	18,437	31,371	191,584	181,328
Benzene:				
Motor grade:				
Coke-oven operators[6]	919,070	1,584,026	3,438,892	8,497,119
All other grades:				
Tar distillers[4]	1,123,305	2,381,928	14,549,528	10,586,340
Coke-oven operators[6]	12,161,976	12,380,492	60,825,931	61,319,133
Butyl alcohol, primary, normal	10,103,815	14,475,015	52,791,858	61,176,033
Carbon bisulphide	37,533,338	29,732,310	172,268,291	143,468,990
Carbon tetrachloride	17,251,426	16,981,654	89,384,271	82,697,207
Chlorobenzene, mono	24,226,129	30,999,589	132,654,325	127,656,293
Creosote oil:				
Tar distillers[4]	8,644,171	10,170,720	.....	54,511,423
Coke-oven operators[6]	2,946,314	3,283,735	15,951,994	16,528,890
Cresols, meta-para	663,632	508,758	3,663,733	2,290,327
Cresols, ortho-meta-para[2]	908,665	944,318	3,515,233	4,056,416
Cresylic acid, refined[2, 10]	2,715,342	2,196,359	11,459,665	11,102,176
Dibutyl phthalate	1,428,480	1,056,590	7,403,936	8,691,823
Dichlorodiphenyltrichloroethane (DDT)	562,648	4,967,831	9,012,514	21,678,128
Ethyl acetate, 85 percent	5,787,618	6,088,211	28,032,176	37,243,121
Ethylene glycol	32,144,429	18,530,506	135,158,259	81,313,767
Ethyl ether	3,218,547	4,212,337	14,155,306	18,608,535
Formaldehyde, 37 percent	45,776,252	55,030,129	224,688,509	274,149,166
Hexachlorocyclohexane	1,769,200	363,126	7,669,657	1,321,030
Methanol, natural[8]	1,348,929	1,518,734	6,890,978	7,007,385
Methanol, synthetic	91,578,301	45,348,286	353,191,029	224,781,018
Naphthalene:				
Tar distillers, less than 79°C	17,827,169	21,189,064	84,460,896	98,889,055
Tar distillers, 79°C. and over	7,966,183	8,685,899	44,103,894	42,220,561
Coke-oven operators, less than 79°C	8,042,261	7,265,148	40,858,328	37,394,256
Penicillin and salts	8,505,435	2,665,250	36,942,700	14,327,913
Phenol	23,408,307	23,911,674	123,213,742	99,154,817
Phthalic anhydride	13,631,777	10,526,497	65,265,961	54,355,466
Styrene, government and private plants	35,591,409	26,716,416	155,299,371	139,145,161
Toluene:				
Coke-oven operators	2,355,183	2,009,789	11,503,834	10,916,214
All other[9]	4,082,063	1,602,261	.....	12,524,823
Xylene, crude	5,841,807	4,146,392	25,125,551	21,191,532

All data in pounds except benzene (gal.) creosote oil (gal.), toluene (gal.) xylene (gal.) and penicillin (million Oxford units). Statistics collected and compiled by U. S. Tariff Commission except where noted. Absence of data on production indicates either that returns were unavailable or confidential. [1]Excludes the statistics on recovered acid. [2]Acid produced by direct process from wood and from calcium acetate. [3]All acetic anhydride including that from acetic by vapor-phase process. [4]Product of distillers who use purchased coal tar only or from oil-gas or water-gas produced or purchased by tar distillers. [5]Statistics are given in terms of bulk medicinals only. [6]Statistics collected by Bureau of Mines. [7]Total production including data reported both by coke-oven operators and by distillers of purchased coal tar. [8]Reported to U. S. Bureau of the Census. [9]Includes toluene produced from petroleum by any process. [10]Includes refined cresylic acid from petroleum.

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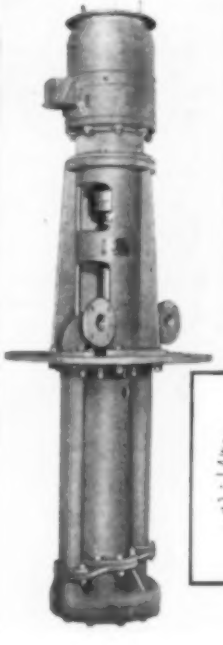

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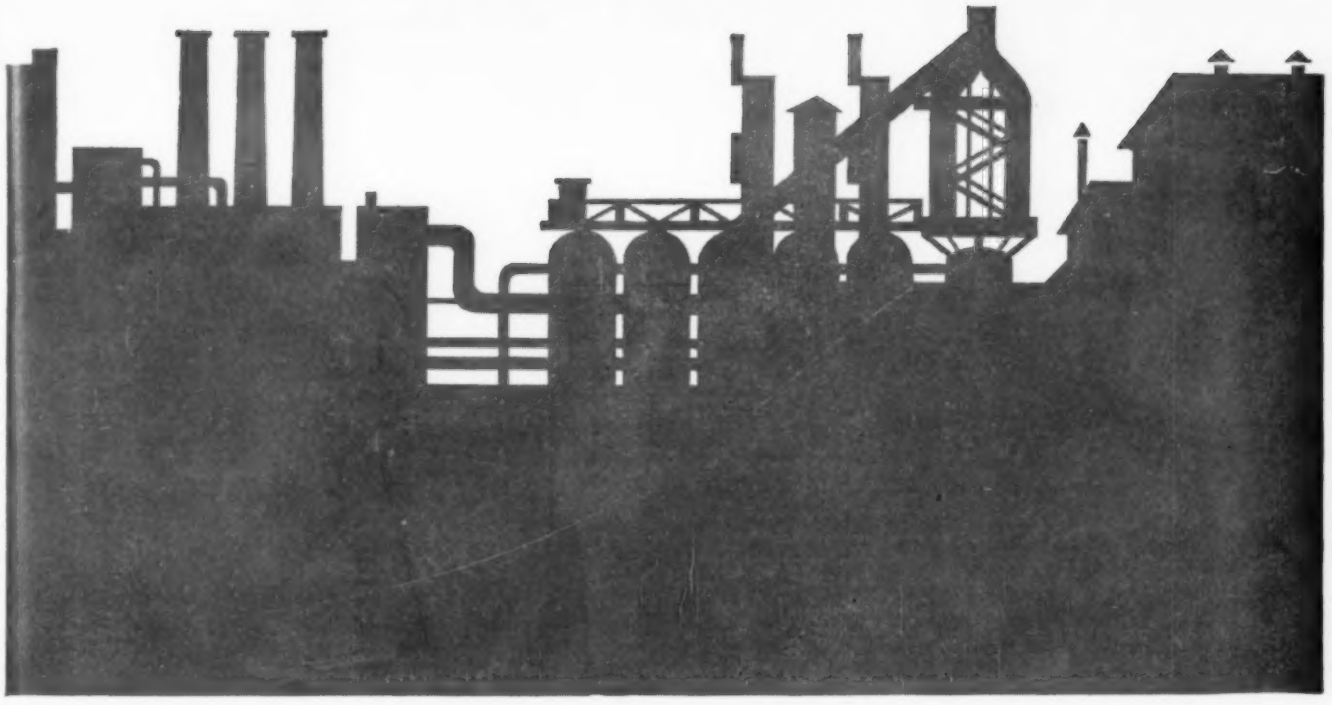

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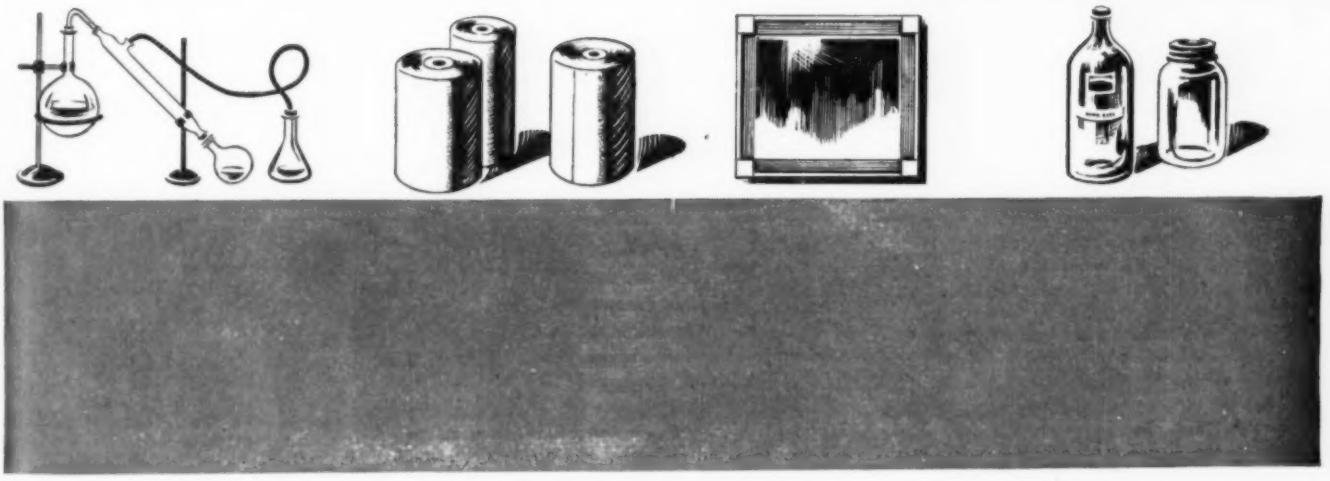

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	Current Projects		Cumulative 1948	
	Proposed Work	Contracts	Proposed Work	Contracts
New England	.....	$125,000	$125,000	$2,206,000
Middle Atlantic	$250,000	168,000	7,611,000	50,863,000
South	3,000,000	965,000	81,353,000	69,533,000
Middle West	.....	19,818,000	12,950,000	51,942,000
West of Mississippi	53,475,000	12,851,000	207,613,000	71,204,000
Far West	6,800,000	100,000	20,450,000	31,317,000
Canada	.....	.....	92,710,000	35,805,000
Total	$63,525,000	$34,027,000	$422,812,000	$312,870,000

Proposed Work

Del., Wilmington—Standard Oil Co. of New Jersey, Standard Oil Bldg., Baltimore, Md., plans addition to its bulk plant here. Estimated cost will exceed $150,000.

Minn., Mankato—Honeymead Mankato, Inc., C. F. Marshall, Pres., plans to construct a soybean processing plant to replace the one recently destroyed by fire. Estimated cost will exceed $100,000.

N. Y., Albany—Hudson Valley Paper Co., Broadway and Tivoli St., plans to construct an addition to its plant. Estimated cost $100,000.

Okla., Tulsa—Stanolind Oil & Gas Co., Stanolind Bldg., plans to construct a research center. Estimated cost $2,000,000.

S. C., Greenwood—Greenwood Cotton Mills, Greenwood, S. C., plans to construct a rayon weaving plant. The McPherson Co., Grenville, Engr. Estimated cost $3,000,000.

Tex., Big Spring—Cosden Petroleum Corp., Big Spring, plans to construct a catalytic cracking unit. Estimated cost $1,500,000.

Tex., Corpus Christi—Erle P. Halliburton & Associates, Driscoll Hotel, plan to construct a cement manufacturing plant to have a capacity of 16,000 sacks daily; also a diesel power plant. Estimated cost $5,250,000 and $250,000 respectively.

Tex., Electra—Texas Co., Texas Bldg., Houston, plans to alter its refinery. Estimated cost $750,000.

Tex., Etter (Dumas P. O.)—Phillips Chemical Co., subsidiary of Phillips Petroleum Co., Bartlesville, Okla., plans to construct an ammonian nitrate plant. Estimated cost $2,500,000.

Tex., Houston—Phillips Chemical Co., subsidiary of Phillips Petroleum Co., Bartlesville, Okla., plans to construct an ammonium sulphate plant on the ship channel near Houston. Estimated cost $6,000,000.

Tex., Houston—Houston Asbestos Co., c/o Frank W. Sharp, 1526 Welch St., plans to double the size of its asbestos plant. Estimated cost $250,000.

Tex., Houston—Phillips Chemical Co., subsidiary of Phillips Petroleum Co., Bartelsville, Okla., plans to construct additional chemical plant units. Estimated cost $3,000,000.

Tex., Houston—Phillips Chemical Co., subsidiary of Phillips Petroleum Co., Bartlesville, Okla., plans to construct an additional ammonium sulphate plant and units for the manufacture of chemicals from other than petroleum derivatives. Estimated cost $30,000,000.

Tex., Houston—South Texas Cotton Oil Co., 2405 Collingsworth St., plans to construct a storage and hydrogen plant. Estimated cost $200,000.

Tex., Howe—Lone Star Gas Co., 1915 Wood St., Dallas, plans to construct a 3,620 hp. compressor station. Estimated cost $325,000.

Tex., Munday—Lone Star Gas Co., 1915 Wood St., Dallas, plans to construct a compressor station in this area. Estimated cost $200,000.

Tex., San Diego—Coast Oil Corp., San Diego, plans to construct a gasoline refinery. Estimated cost $750,000.

Tex., Texas City—Pan-American Refining Corp., H. R. Snow, Mgr., Texas City, plans to construct a gate house, change house, pilot plant, chemical laboratory and office. Estimated cost $400,000.

Utah, Garfield—American Smelting & Refining Co., Pacific National Life Bldg., Salt Lake City, plans to construct an acid plant. Estimated cost $6,800,000.

Contracts Awarded

Ark., Crossett—Crossett Paper Mills, Crossett, have awarded the contract for an addition to their paper mill to Rust Engineering Co., Clark Bldg., Pittsburgh, Pa. Estimated cost will exceed $68,000.

Calif., Mt. Eden—Mt. Eden Chemical Co., Mt. Eden, has awarded the contract for a chlorine plant here to Murphy Construction Co., Jefferson Ave., Redwood City. Estimated cost $100,000.

Conn., Stamford—Plastic Manufacturing Co., Inc., 280 Fairfield Ave., has awarded the contract for a 1 story, 100x132 ft. and a 2 story, 60x115 ft. plant to William J. Lyons, 9 Mechanic St., Norwalk. Estimated cost $125,000.

Fla., Jacksonville—Turpentine & Rosin Factors, Atlantic National Bank Bldg., will construct a turpentine distillation plant for producing Oleoresin turpentine and rosin. Work will be done by owner. Estimated cost $200,000.

Ill., Decatur—Spencer, Kellogg & Sons, Niagara Sq., Buffalo, N. Y., have awarded the contract for a refining plant, vegetable oil and soybean meal mills and storage plant here to Crosby Construction Co., 185 North Wabash Ave., Chicago, Ill. Estimated cost $3,000,000.

Ill., East St. Louis—Aluminum Ore Co., 3300 Missouri Ave., has awarded the contract for a 95 x 120 ft. by 85 ft. high building for the manufacture of fluoride chemicals and ceramic cryolite to Fruin-Colnon Contracting Co., 1706 Olive St., St. Louis. Estimated cost including equipment $750,000.

Ind., Whiting—Standard Oil Co., 910 South Michigan Av., Chicago, Ill., has awarded the contract for a 4 story, 180x325 ft. barrel house to George A. Fuller Co., 111 West Washington St., Chicago.

Ky., Owensboro—Fleischman Distilling Co., Owensboro, has awarded the contract for units 1 and 2, 350x400 ft. warehouse, to George H. Rommel Co., 958 Loaga St., Louisville. Estimated cost $650,000.

N. C., Winston Salem—B & L Construction Co., Winston-Salem, will construct a ready-mix concrete plant with own forces. Estimated cost $115,000.

O., Lima—Standard Oil Co. of Ohio, Midland Bldg., Cleveland, has awarded the contract for a catalytic cracking plant at its refinery, including gas plant, gasoline treating and blending facilities and 20,000,000 gal. addition to tankage facilities; also combination crude oil distillation and coking plant to Arthur G. McKee Co., 2300 Chester St., Cleveland. Estimated cost $11,000,000 and $5,000,000 respectively.

Okla., Ponca City—Continental Oil Co., Ponca City, will enlarge its refinery to increase its capacity from 33,500 bbl. to 53,000 bbl. per day. Work will be done with own forces. Estimated cost $7,750,000.

Pa., Marcus Hook—General Chemical Co., 1100 Line St., Camden, N. J., has awarded the contract for an industrial building to Wigton-Abbott Corp., 1225 South Ave., Plainfield, N. J. Estimated cost $100,000.

Pa., Philadelphia—Delta Finishing Co., Lewis and Ashland Sts., has awarded the contract for a dye plant addition to L. E. Bender, 1137 Wakeling St. Estimated cost will exceed $68,000.

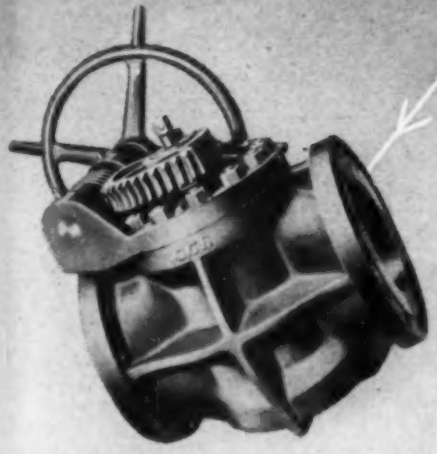
Tex., Baytown—Humble Oil & Refining Co., Baytown, has awarded the contract for three shop buildings to H. K. Ferguson Co., M & M Bldg., Houston. Estimated cost $4,750,000.

Tex., Dallas—Southwestern General Construction Co., 2231 Irving Blvd., will construct a hot mix asphalt plant in the Trinity Industrial District. Work will be done by owner. Estimated cost $80,000.

Tex., Orange—Texas Creosoting Plant, Orange, will reconstruct portions of creosoting plant. Work by owners. Est. $78,000.

Tex., Thackerville—Standard Oil Co. of Texas, City Natl. Bank Bldg., Houston, will construct a natural gasoline plant. Work will be done with purchase and hire. Estimated cost $125,000.

Only a Cylindrical Plug turns so easily!



Precision machined, the a.c.f. Cylindrical Plug operates without wedging in its seat. It makes possible a port opening of full pipe area where needed, with retention of compact plug valve construction.

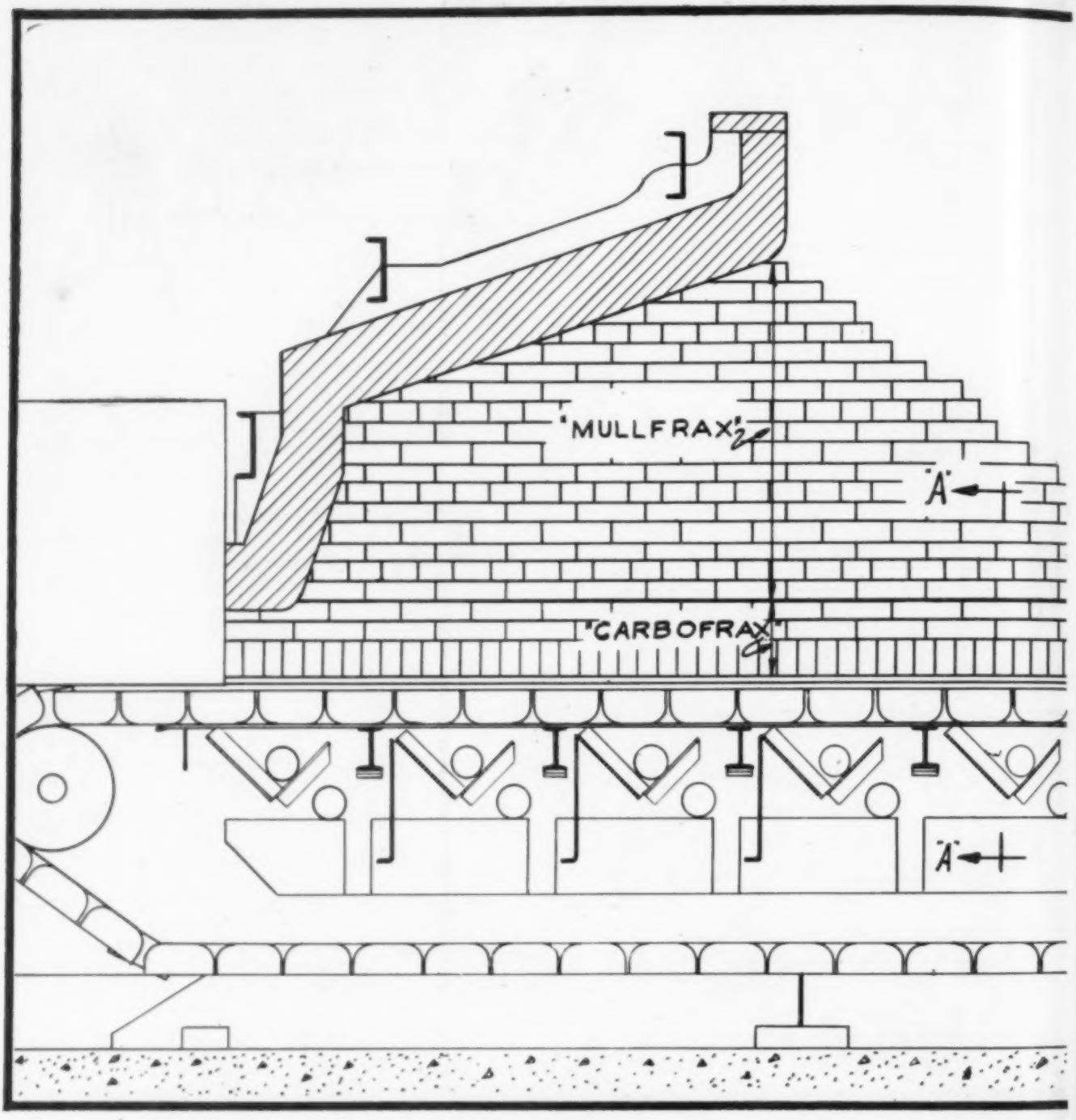
CYLINDRICAL FULL PIPE AREA LUBRICATED

a.c.f. PLUG VALVES

Representatives in more than 50 Principal Cities

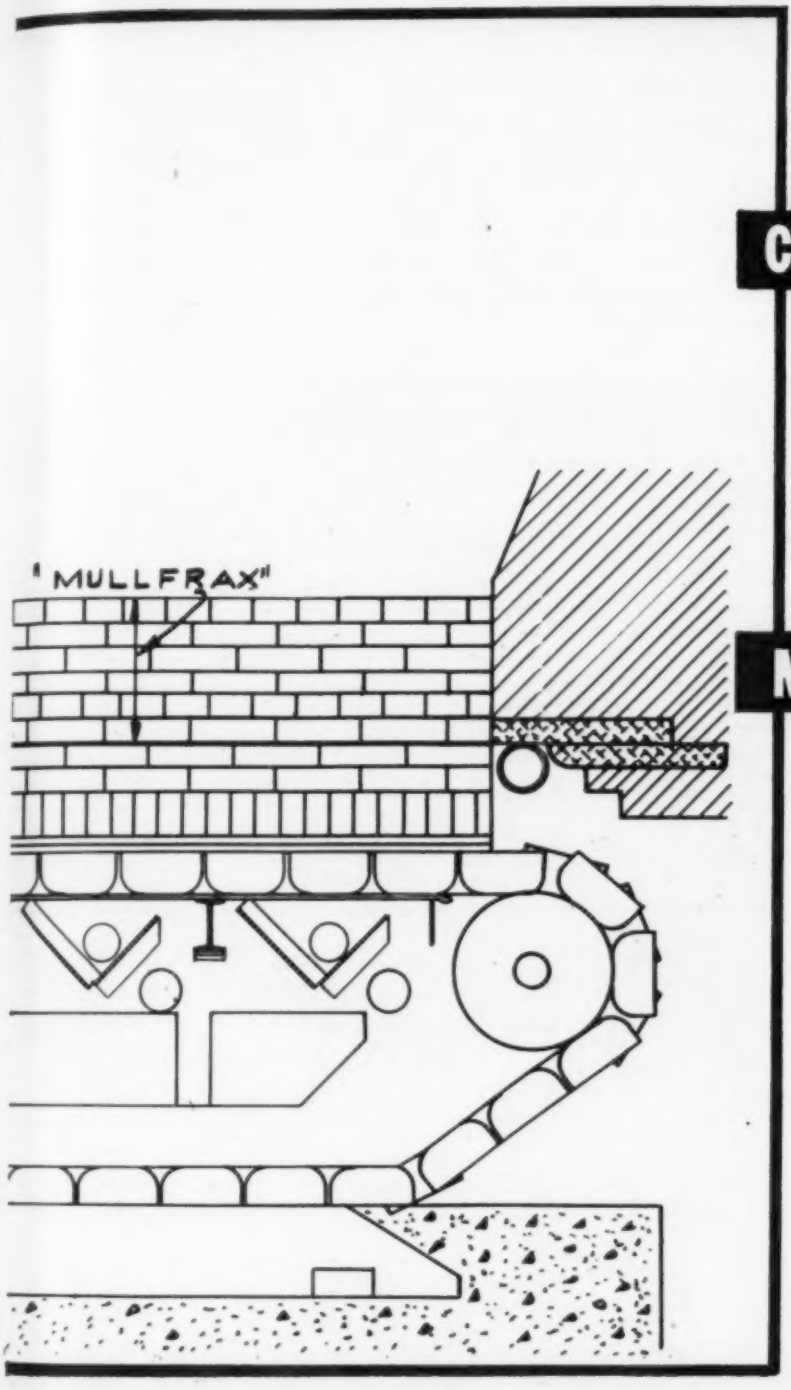
Reference Catalog No. 3-CM—of types and sizes available on request. Write American Car and Foundry Company, Valve Division, 30 Church Street, New York 8, N. Y.

A Super Refractories Combination



SUPER

that stands up to Low Fusion Ash Coals



Destructive slags from high pyritic sulphur coals are combatted successfully by using super refractories by CARBORUNDUM. Shown by the drawing is a typical application. Operating conditions, of course, determine actual heights of linings for specific installations.

CARBOFRAX silicon carbide brick are installed in the fuel bed zone where there is little likelihood of molten slag attack. They offer no anchorage for choking clinker accumulations. Their hard dense faces are kept clean by the moving fuel bed. Full grate area is available. Operation is more efficient. Greater steaming capacity is provided. Maintenance costs are cut. Because of high resistance to elevated temperatures, mechanical abrasion, spalling and flame erosion, CARBOFRAX brick last longer. Frequent repairs are eliminated.

MULLFRAX electric furnace mullite brick are installed above the CARBOFRAX brick belt in those sections where most severe conditions exist. They solve a dual problem. Remaining hard at high temperatures, these brick are impenetrable to any clinker formations resulting from variations in fuel bed depth. Accumulations are barred off easily, quickly without harming the brickwork. Resistant to fluid ash, chemically inert MULLFRAX brick retard erosion. Moreover, freedom from cracking and spalling helps insure superior performance-assists in promoting more continuous service.

This combination of super refractories by CARBORUNDUM steps up steam production . . . slashes maintenance expense in furnaces burning high sulphur, low fusion ash coals. Individually and in combination, they produce similar results in other applications. Use them on your next repair job. Investigate them for other jobs. Write Dept. L-98 for facts. The Carborundum Company, Refractories Division, Perth Amboy, N. J.

REFRACTORIES

BY CARBORUNDUM

TRADE MARK

"Carborundum," "Carbofrax" and "Mullfrax" are registered trademarks which indicate manufacture by The Carborundum Company.

MORE THAN 11 TONS OF 18-8 CASTING!

The customer who ordered this giant believes it is the largest casting of this type and analysis that has ever been attempted and made. We think he is right. At least it weighs 22,800 pounds. Midvale skill and experience in making stainless castings of any size from 1 to 50,000 pounds left no room for jitters on this job.

HEAT ANALYSIS S/8549

C	MN	P	S	Si	Cr	Ni
.06	.73	.025	.016	1.31	19.25	8.85

MECHANICAL PROPERTIES

T.S.	Y.P.	Ext.	Cont.
79,500	39,500	45%	55.5%

Large or small, all Midvale heat and corrosion resisting castings get expert handling.

THE MIDVALE COMPANY • NICETOWN • PHILADELPHIA

OFFICES: NEW YORK • CHICAGO • PITTSBURGH
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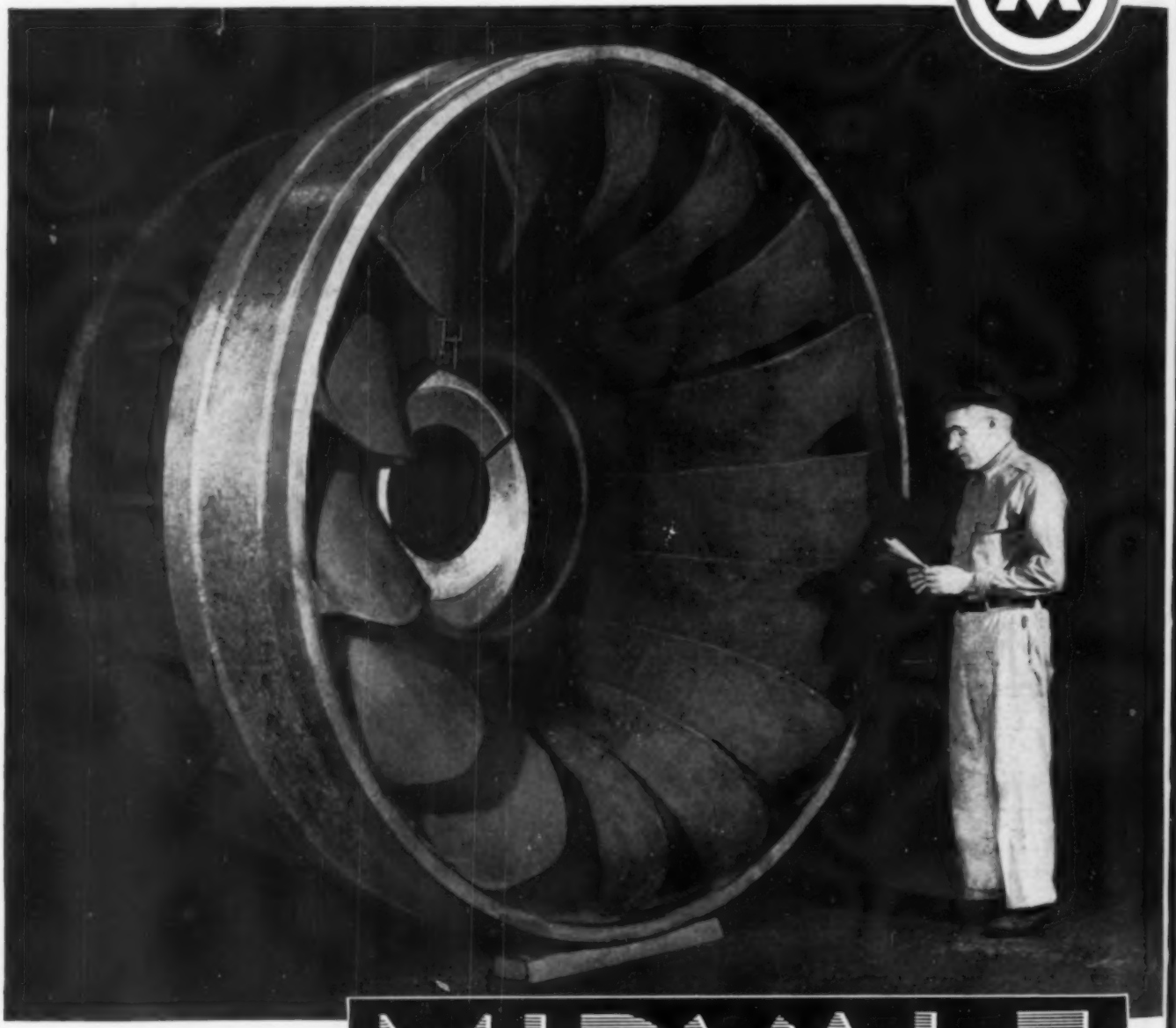
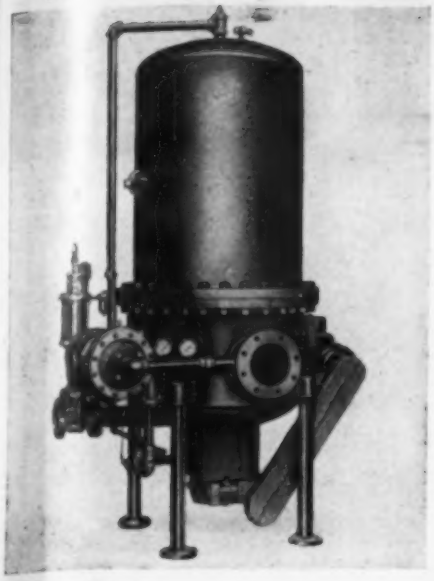


STAINLESS AND TOOL STEEL BARS
•
CORROSION AND HEAT RESISTING CASTINGS
•
FORGINGS AND RINGS

MIDVALE

Custom Steel Makers to Industry

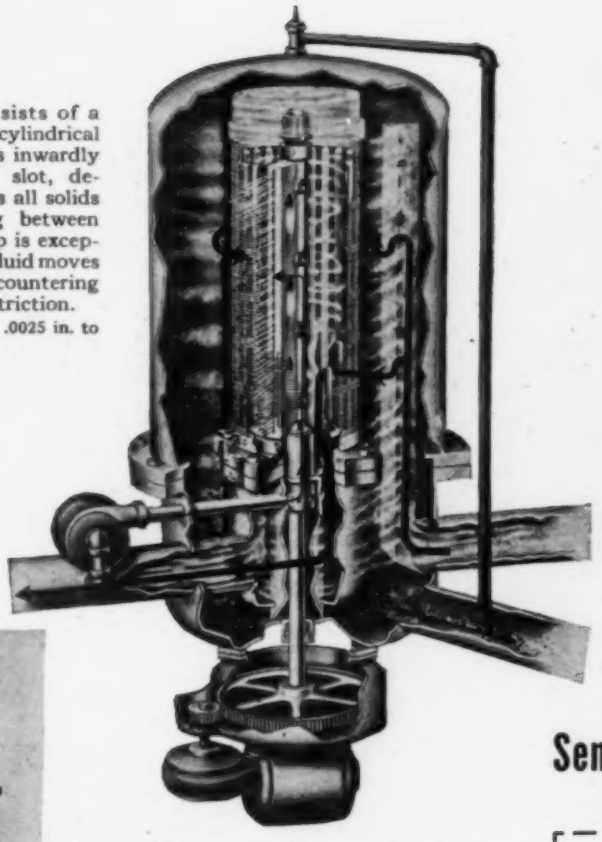


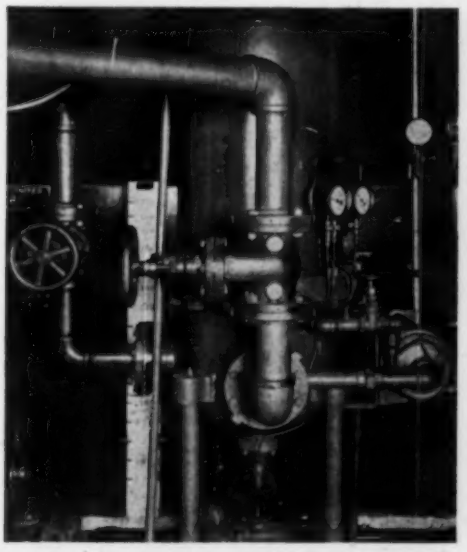
It pulls teeth out of fluids painlessly

When fluid carries abrasives that would be as tough on the filter as on the machinery—that's the spot for the Flo-Klean. Its filter element positively cleans the fluid and continuously cleans itself . . . and is *permanent*—non-corrosive, abrasive-resistant.

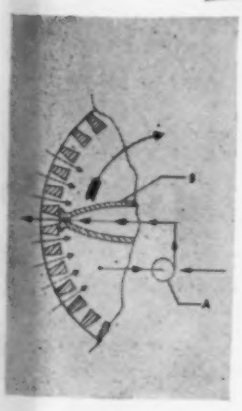
Filter element consists of a wire-wound, slotted cylindrical "cage". Fluid passes inwardly between wires and slot, depositing on the wires all solids larger than spacing between them.* Pressure drop is exceptionally low because fluid moves in a straight line encountering only momentary restriction.

*Available spacing from .0025 in. to .020 in.





Cuno Flo-Klean is ideal for protecting nozzles, orifices, spray heads, control equipment, etc., from clogging and wear due to sand, pipe scale, etc., in water, water solutions, and various low-viscosity fluids. Single filter will handle up to 8,000 gpm.



Recirculating pump (A) returns small proportion of filtered fluid into system under elevated pressure through rotatting nozzle (B), removing deposits. There is no loss of backwash fluid; no interruption of flow; no need for duplex installation.

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CUNO ENGINEERING CORPORATION
104 South Vine St., Meriden, Conn.

Please send information—without obligation—on Cuno continuous cleaning for application noted:

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PLEASE ATTACH COUPON TO YOUR BUSINESS LETTERHEAD

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Fluid Conditioning

REMOVES MORE SIZES OF SOLIDS FROM MORE TYPES OF FLUIDS

Micronic . . . Disc-Type . . . Wire-Wound . . . Fabric Filters

Making the broadest line of fluid filters, Cuno is your best source for unbiased recommendations on any fluid filtration problem.

How TOUGH

OVER 5 YEARS ON THE JOB — CONTINUOUSLY! That's the record of this 5 hp motor. Heat, moisture and chlorine fumes make this chemical location a real test of motor value.

EXPLOSION - PROOF MOTORS. Designed to give absolute safety in the most dangerous locations. Multiple seals isolate inside of motor from outside air. Approved for Class I, Group D locations.

SPLASH - PROOF MOTORS. Sturdy, rigid construction with ample protection from top or side directed particles or liquids. Suitable for outdoor use. Available with 50°C or 40°C temp. rise guarantee.

TUBE VENTILATED MOTORS. Totally enclosed, fan-cooled with newly designed heat transfer system that offers protection against both explosive vapors and corrosive atmospheres. Excellent for outdoor use.

ALLIS-CHALMERS

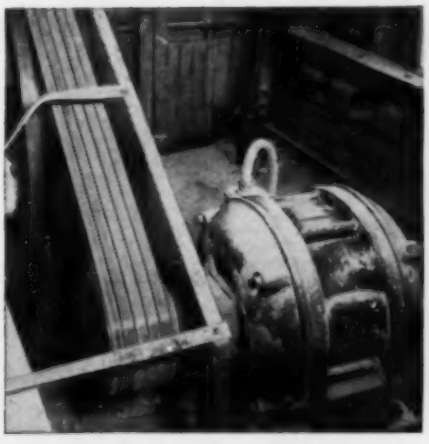
One of the Big 3 in Electric Power Equipment — Biggest of All in Range of Industrial Products

A CENTURY OF SERVICE to Industry THAT MADE America Great

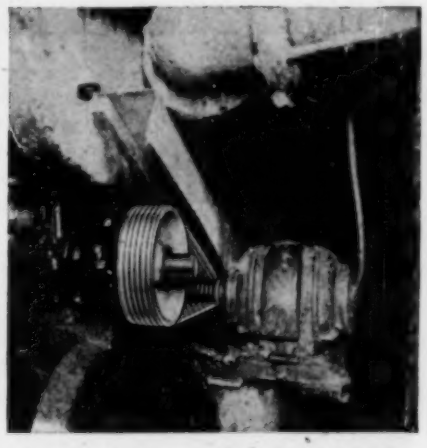
can you be with a Motor?

STAMINA OF ALLIS-CHALMERS MOTORS HAS BEEN PROVEN ON SOME OF THE WORLD'S TOUGHEST JOBS...

ALLIS-CHALMERS MOTOR AND PUMP combination handles caustic soda in chemical plant. Special seals offer maximum bearing protection.



STANDARD SQUIRREL-CAGE Allis-Chalmers motor and Texrope drive furnish dependable power in an atmosphere that is heavily dust-laden.



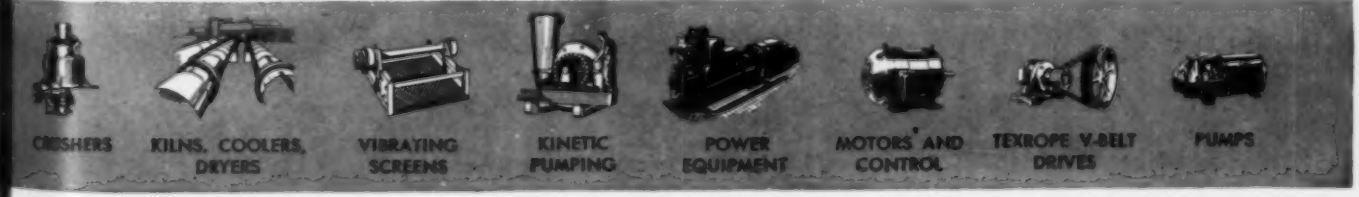
SPLASH-PROOF INDUCTION MOTOR and Texrope drive in a pulp mill location. Severe vibration was an added motor hazard on this job.

MOTOR-PUNISHING FUMES AND CORROSIVE vapors . . . moisture . . . heat . . . gritty, abrasive dust — it takes *top-quality* motors to avoid trouble on jobs like these! That's why many chemical men demand motors built by Allis-Chalmers.

For Allis-Chalmers motors have measured up under some of the worst operating conditions in all industry. Sound design and outstanding strength characteristics pay off well in chemical processing ... in reliability and long service life.

For especially adverse conditions, Allis-Chalmers offers motors with special deterioration-resisting insulation . . . motors with new and basically different heat transfer systems for improved cooling . . . explosion-proof and splash-proof motors.

Your nearby A-C representative will gladly explain how the *complete* Allis-Chalmers motor line may help you avoid costly shutdowns due to motor failures. Get in touch with him today. ALLIS-CHALMERS, MILWAUKEE 1, WISCONSIN. A 2323

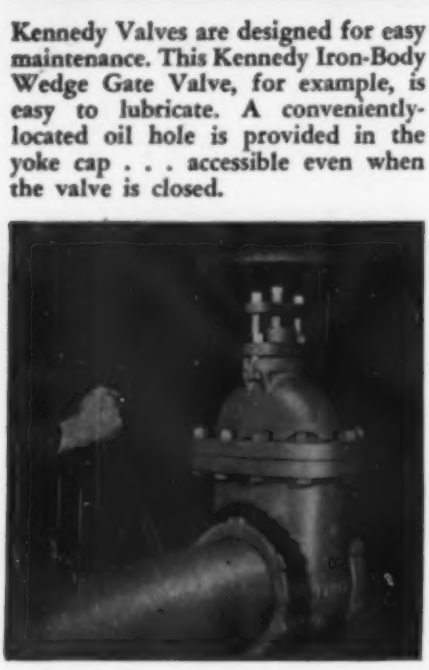


MAINTENANCE IS EASY when you use Kennedy Valves

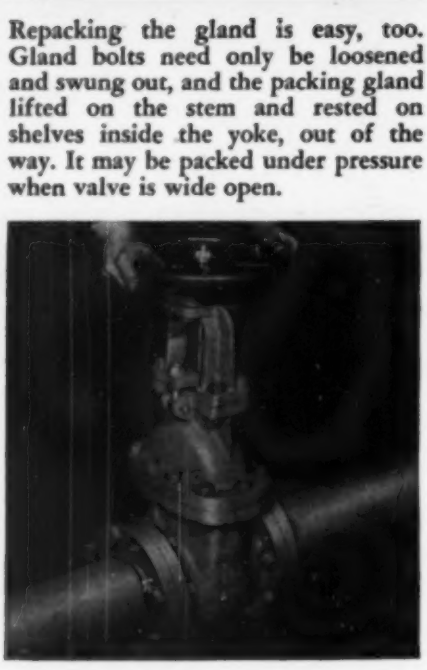
Kennedy Valves are designed for easy maintenance. This Kennedy Iron-Body Wedge Gate Valve, for example, is easy to lubricate. A conveniently-located oil hole is provided in the yoke cap . . . accessible even when the valve is closed.

Repacking the gland is easy, too. Gland bolts need only be loosened and swung out, and the packing gland lifted on the stem and rested on shelves inside the yoke, out of the way. It may be packed under pressure when valve is wide open.

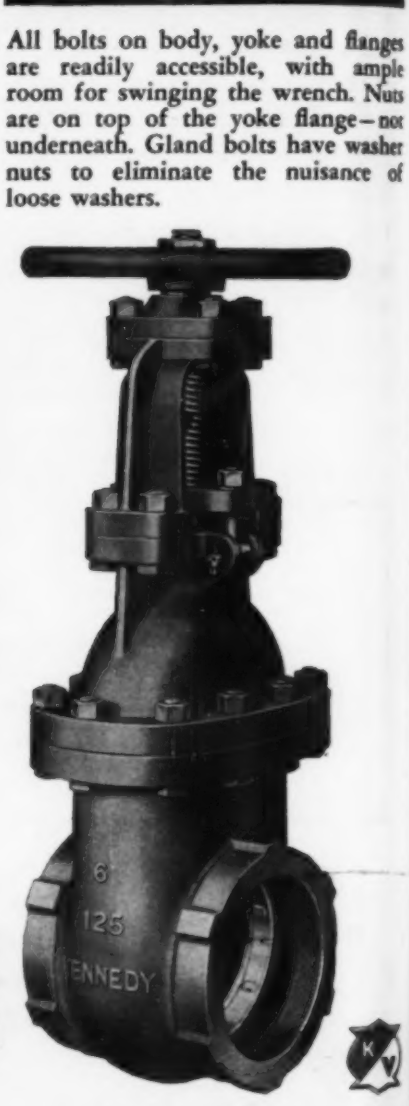
All bolts on body, yoke and flanges are readily accessible, with ample room for swinging the wrench. Nuts are on top of the yoke flange—not underneath. Gland bolts have washer nuts to eliminate the nuisance of loose washers.



On screwed end valves, lugs are provided around the outside of the end connections for convenience in applying a pipe or chain wrench.



Operation of the valve, too, is easy. The large-diameter hand-wheel provides ample leverage for effortless opening and closing of the valve.



The Kennedy Iron-Body Wedge Gate Valve is only one of hundreds of Kennedy Valves, all designed for minimum maintenance, easy operation, and long service life. For details see Kennedy's 240-page Catalog.

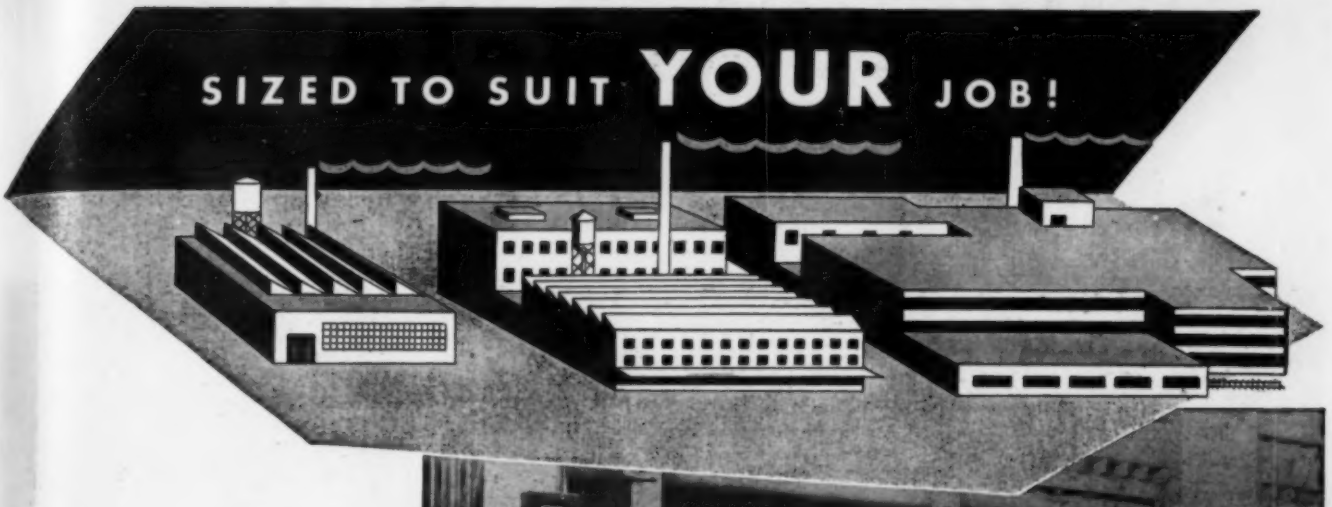
THE KENNEDY VALVE MFG. CO., ELMIRA, NEW YORK
Offices and Warehouses in Principal Cities

KV-175

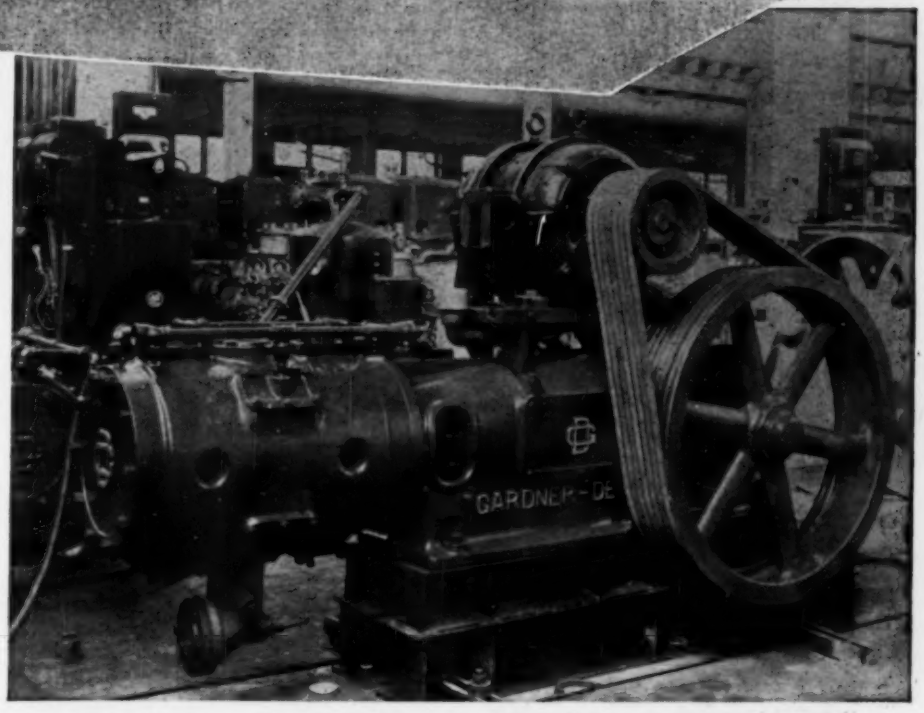
BUY FROM YOUR LOCAL DISTRIBUTOR

KENNEDY valves - pipe fittings - fire hydrants

SIZED TO SUIT YOUR JOB!



When air is required at less than the usual shop pressures, you'll want to be sure your compressor is the correct size. And you *are* sure when you use a Gardner-Denver "RX" Compressor. For this compressor, built for heavy-duty, full-load service, is available in a wide range of sizes—correct for any capacity and any pressure.



Gardner-Denver "RX" Single Stage Horizontal Compressor—available in capacities from 89 to 1292 cubic feet displacement per minute.

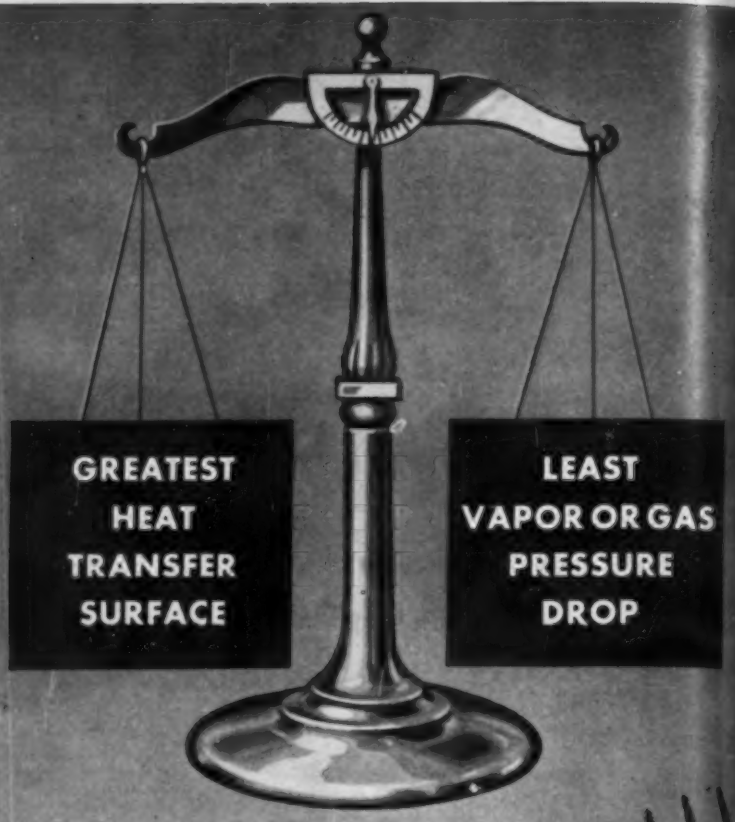
Additional features which make the "RX" a favorite in so many industries:

- **Duo-Plate cushioned valves — simple, durable, unusually quiet.*
- **Suction valve unloaders on all inlet valves result in lowest power consumption during unloaded period.*
- **Crankshaft supported by Timken adjustable double row tapered roller bearings.*
- **Main frame completely enclosed—oil and dust tight. All working parts are easily accessible.*

For complete information, write Gardner-Denver Company, Quincy, Illinois

GARDNER-DENVER SINCE 1859

Why the G-R K-FIN design balances these two ideals

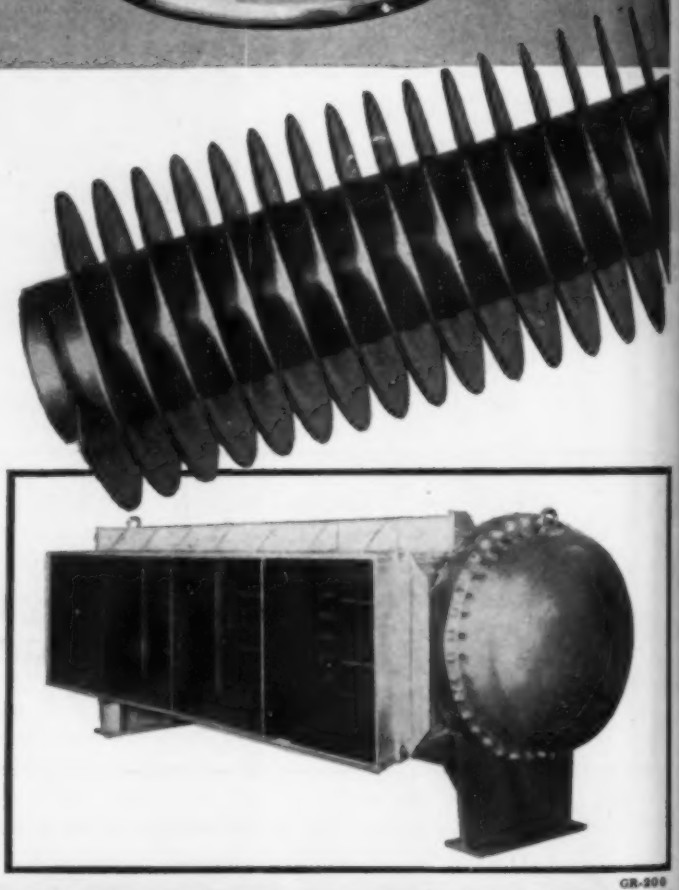


Condensing or cooling vapors or gases of low heat conductivity with water normally requires large units with a multiplicity of tubes in conventional designs.

However, the G-R K-Fin Vapor Condenser or Gas Cooler requires only a comparatively small number of heat transfer elements to condense a vapor or cool a gas. This is because of the helical K-Fins which have 6 to 8 times the external heat transfer surface of bare tubes. Therefore, the unit has wide tube spacing that provides extremely low pressure drop, and at the same time gives large free area of flow in a shell of reasonable size.

And note these additional benefits . . . fewer tubes to clean . . . fewer tube joints to maintain . . . higher velocity of the water or other cooling liquid.

The many types of G-R K-Fin units and their important distinctive advantages of design and construction are explained in our Bulletin 1626 which will be sent on request.

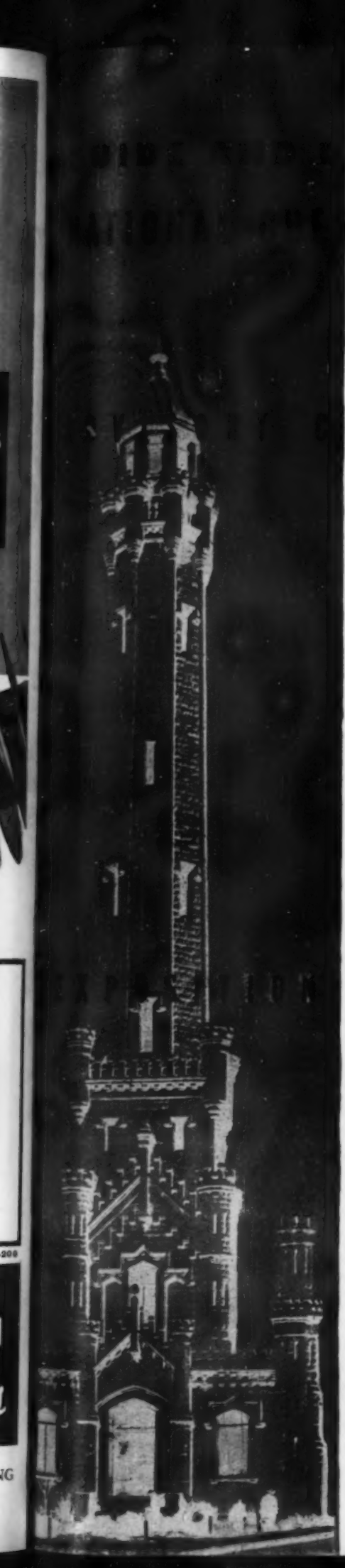


GR-200

THE GRISCOM-RUSSELL CO.
285 MADISON AVENUE • NEW YORK 17, N. Y.

GRISCOM-RUSSELL

Pioneers in Heat Transfer Apparatus



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CHICAGO COLISEUM

OCTOBER 12, 13, 14, 15, 16-1948

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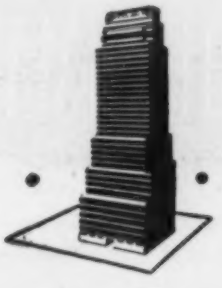

(A Quick Quiz on modern pH advancements)

Do you know these important facts about BECKMAN pH CONTROL?

Do you know...

That Beckman pioneered modern glass electrode pH equipment?

Until Beckman pH instruments were developed, glass electrode pH equipment was a cumbersome, complicated laboratory curiosity. It was Beckman that pioneered today's simple, compact, highly accurate and completely dependable glass electrode pH equipment!

That Beckman pioneered virtually every major development in modern glass electrode pH equipment?

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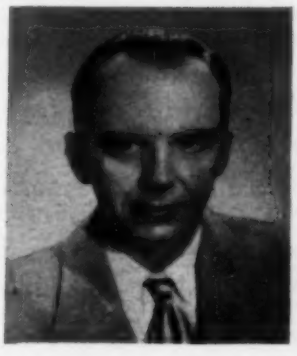

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UNION BAG & PAPER CORPORATION, 233 Broadway, New York 7, New York. Host: G. W. Donaldson 112–113

UNITED STATES GASKET COMPANY, Post Office Box 93, Camden, New Jersey. Host: D. L. Hoxworth 222

U. S. INDUSTRIAL CHEMICALS, INC., 60 East 42nd Street, New York 17, New York 138–139

UNITED STATES STEEL CORPORATION, 436 Seventh Avenue, Pittsburg 30, Pennsylvania. Host: Raymond P. Haverty 336

UNITED STATES STEEL PRODUCTS COMPANY, 14600 Princeton Avenue, Chicago 27, Illinois 336

UNITED STATES STEEL SUPPLY COMPANY AND COAL CHEMICAL DIVISION, 1319 West Wabansia Avenue, Chicago 22, Illinois 336

THE U. S. STONEWARE CO., Akron 9, Ohio. Host: L. E. Wybel 40–41–42

VICTOR CHEMICAL WORKS, 141 West Jackson Boulevard, Chicago 4, Illinois. Host: E. M. Myers .. 53–54–55–62–63–64

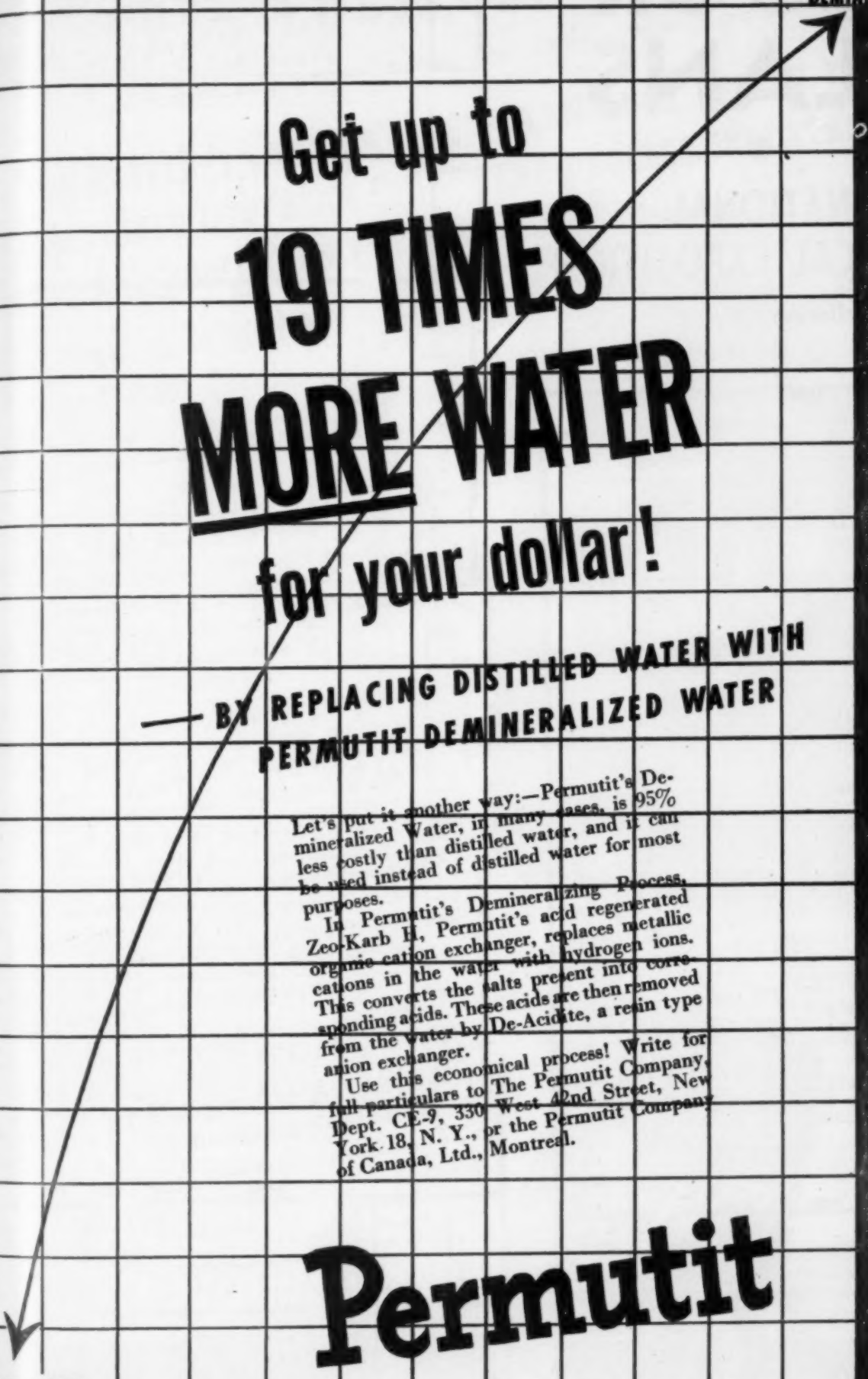
WALKER-WALLACE INCORPORATED, 1370 Main Street, Buffalo 9, New York. Host: Earl W. Hall 223

WALLACE & TIERNAN PRODUCTS, INC., One Main Street, Belleville 9, New Jersey. Host: J. L. Grahek .. 342

W. M. WELCH SCIENTIFIC CO., 1515 Sedgwick Street, Chicago 10, Illinois. Host: J. Gutsmiedl 129

WILKENS-ANDERSON COMPANY, 111 North Canal Street, Chicago 6, Illinois. Host: W. C. Burfischer 111

WORTHINGTON PUMP AND MACHINERY CORPORATION, Advertising Department, Harrison, New Jersey .. 204–205



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Use this economical process! Write for full particulars to The Permutit Company, Dept. CE-9, 330 West 42nd Street, New York 18, N. Y., or the Permutit Company of Canada, Ltd., Montreal.

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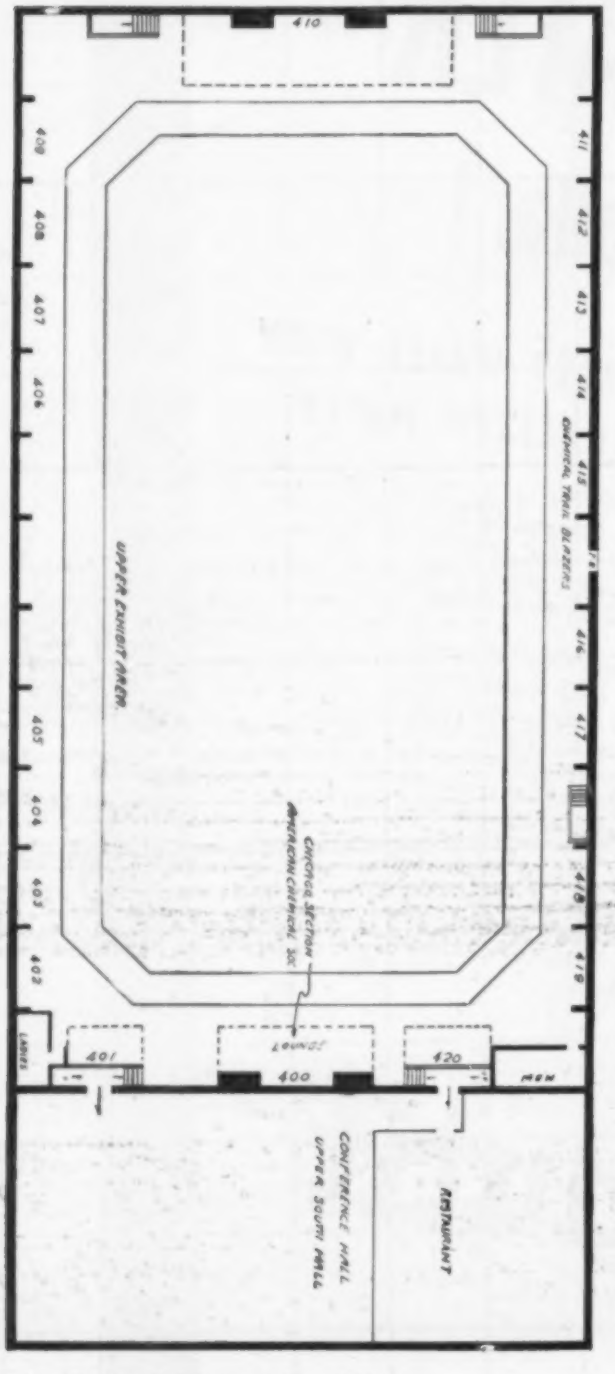
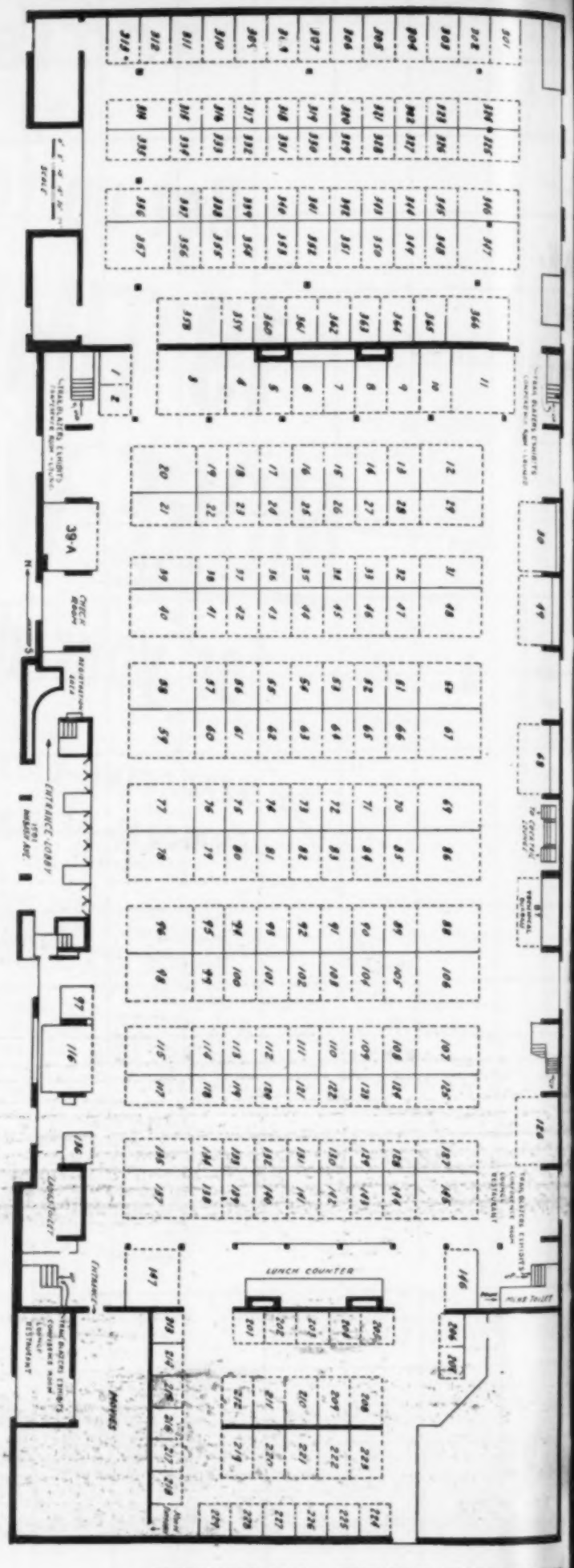
FLOOR PLANS

NATIONAL CHEMICAL EXPOSITION

Chicago Coliseum

October 12-16, 1948





PROCESS EQUIPMENT NEWS

AW-KNOX DEVELOPS COMPACT, SELF-CONTAINED DOWTHERM HEATING AND COOLING UNIT

for Smaller Industries and Pilot Plants

A complete (assembled) Dowtherm heating and cooling unit, ready for use when connected with water and power supply, is now available to commercial users and pilot plant operators.

Blaw-Knox is offering this Dowtherm system with a range from room temperature to 700°F and a heating capacity of 100,000 BTU per hour.

As shipped, the unit is "all there," says the manufacturer, "Just connect the four valves to your equipment, bring electricity and water to the unit, and you have controlled heating and cooling ready for use."

Special advantages claimed for the Blaw-Knox unit include quick and simple installation, convenience and complete control in use, compactness and small space requirement, and the other well-known advantages of an electrically heated Dowtherm system.

The manufacturer may be addressed at:

BLAW-KNOX DIVISION
of Blaw-Knox Company

2090 Farmers Bank Building • Pittsburgh 22, Pa.

New York • Chicago • Philadelphia
Birmingham • Washington
Export Department • Canadian Pacific Bldg.
342 Madison Ave., New York, N. Y.

BLAW-KNOX OFFERS TO THE PROCESS INDUSTRIES

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to carry projects through from …
scale production. The project is kept mov…

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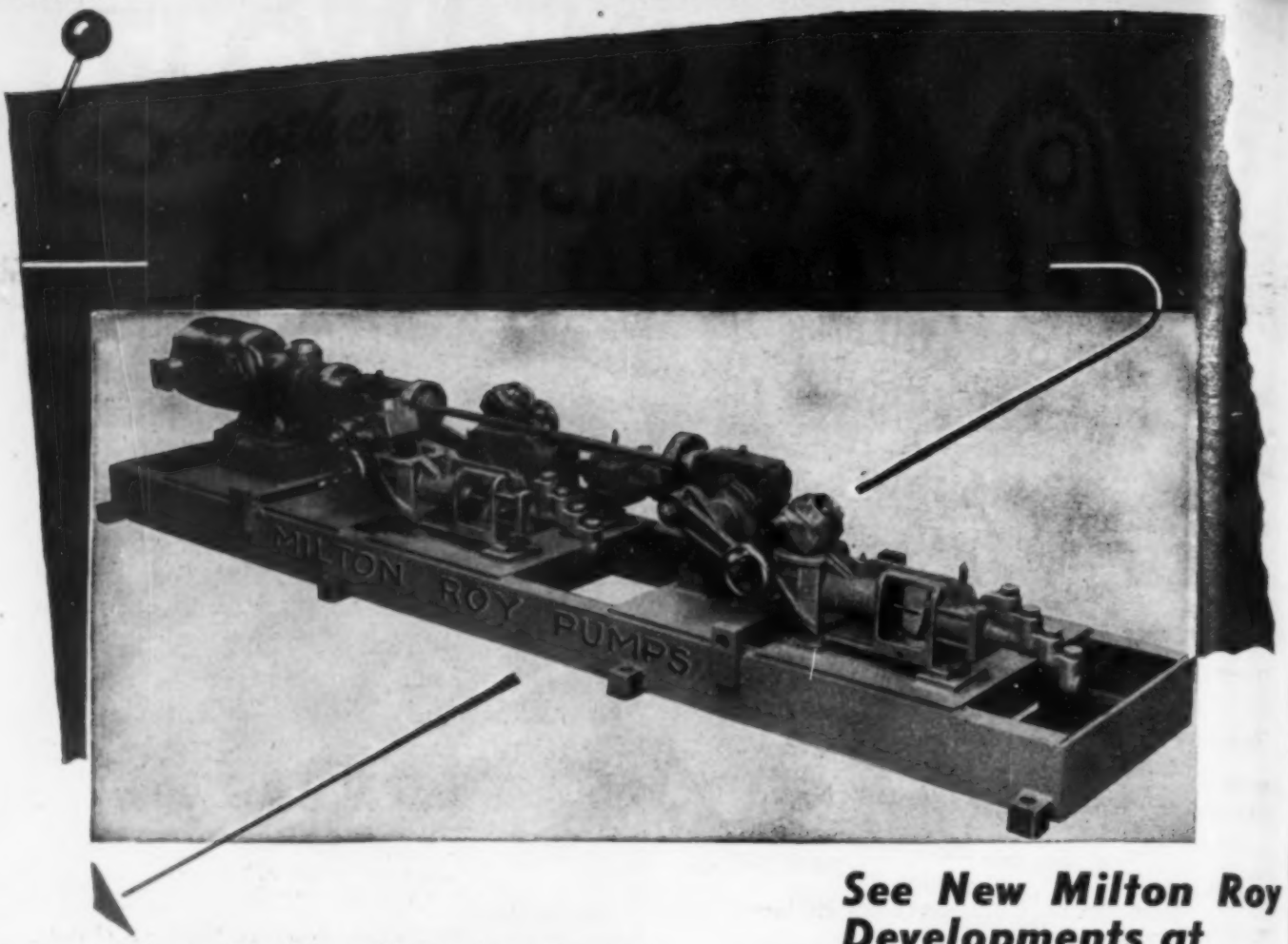
… Plants Division is a closely …dinated group of engineers

SEND for Bulletin No. 2204 describing Complete Plants and Equipment for the Process Industries

BLAW-KNOX IMPLEMENTS THE PROCESS INDUSTRIES



See New Milton Roy Developments at Chicago Oct. 12-16

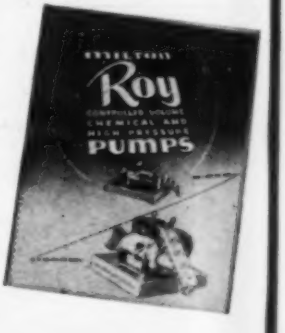
- **Three Positive Metering Pumps**
- **Add Chemicals in Small Quantities**
- **Without the Inaccuracies Inherent in Indirect Metering**

Milton Roy "Gang" Pumps are applicable for many chemical processing and treating purposes. The unit shown is a typical 3-cylinder "Gang," each cylinder pumping a separate treating chemical, the volume of each stream being independently controlled, while pumps are operating. The speed of the unit is set to the speed of the process and may be varied over a wide range by means of the "Speed Ranger" motor drive.

This is another example of a complete Milton Roy "Packaged" System, engineered for a specific application, to afford positive control in pumping small quantities of chemicals without the inaccuracies inherent in indirect metering.

Milton Roy "Gang" Pumps are supplied for manual control as in the above instance, also with Thymotrol control for regulating the speed of the unit automatically. Automatic systems are available for any process in which a metered variable can be measured to set a potentiometer for pump speed control.

"Gang" units retain all the many advantages of individual Milton Roy Step-Valve Pumps—positive metering, self-cleaning and non-clogging operation, construction to meet practically all corrosion resistance requirements, cylinders to pump from 1 pint per hour to 46 gallons per minute, and others. The "Gang" is simply a group of two to ten standard Milton Roy cylinders with a common drive, mounted on a common base. Such a "Gang" has almost unlimited possibilities—consider it for your pumping problems.



Write for general Catalog No. 146 and Technical Paper No. 57 "Controlled Volume Chemical Pumps Design and Operation" reprinted from Chemical Engineering Progress, April, 1948.

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NATIONAL INDUSTRIAL CHEMICAL CONFERENCE

• program •

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TUESDAY EVENING, October 12—7:30 p.m.
Chemical Market Development
Planned and prepared by Commercial Chemical Development Association
Chairman, W. B. PLUMMER
Chemical Products Department
Standard Oil Company (Indiana)
"Some Basic Aspects of Commercial Chemical Development"—
H. M. Corley, Armour and Company
"A Case History of Commercial Chemical Development"—
D. K. Ballman, The Dow Chemical Company
"Use of Chemical Market Data"
R. M. Prather, Standard Oil Company (Indiana)

WEDNESDAY AFTERNOON, October 13—2 p.m.
Chemistry in General Industry
Chairman, R. C. NEWTON
Swift & Company
"Meat Packing Industry" *J. D. Porsche, Armour and Company*
"The Graphic Arts"
M. C. Rogers, R. R. Donnelley & Sons Company
"The Aircraft Industry"
C. C. Furnas, Cornell Aeronautical Laboratories
"Electrical Equipment" *C. E. Reed, General Electric Company*
"Building Material Industry"
C. F. Rassweiler, Johns-Manville Company

WEDNESDAY EVENING, October 13—7:30 p.m.
Hazards from Chemicals
Chairman, WALTER J. MURPHY
Editor, Chemical and Engineering News
"Health Hazards" *R. M. Watrous, M.D., Abbott Laboratories*
"Fire Prevention in the Chemical Industry"
Garrett B. James, Sr., W. H. Markham & Co.
"Disaster Prevention and Control"
R. C. Stratton, Travelers Insurance Company

THURSDAY AFTERNOON, October 14—2 p.m.
Planned and prepared by the Industrial Research Institute
Chairman, E. W. ENGSTROM
RCA Laboratories
President, Industrial Research Institute
Introductory Remarks *Dr. E. W. Engstrom*
"Organization and Management of Research Personnel"
R. C. Newton, Swift and Company
Discussion Panel:
A. G. Ashcroft, Director of Research, Alexander Smith & Sons Carpet Co.
M. G. Shepard, General Development Manager, Naugatuck Chemical
Ralph T. K. Cornwell, Director of Research Sylvania Division, American Viscose Corporation
"Project Selection and Control"
C. G. Harrel and Frank Gunderson, Pillsbury Mills, Inc.
Discussion Panel:
H. N. Stephens, Director of Research, Minnesota Mining & Manufacturing Company
Thomas H. Vaughn, Director of Research, Wyandotte Chemicals Corporation
John P. Magos, Director of Research, Crane Company
"Putting Research Results to Work"
Paul D. V. Manning, International Minerals & Chemical Corporation
Discussion Panel:
A. S. Davis, Resident Attorney, Research Corporation
A. L. Malone, General Manager of Research, Continental Can Company, Inc.
Fred Olsen, Director of Research, Western Cartridge Company

THURSDAY EVENING, October 14—6 p.m.
SUBJECT TO BE ANNOUNCED—Charles A. Thimas, Monsanto Chemical Company, President of the American Chemical Society
This is the Chicago Section October meeting, with a dinner preceding the talk. It will be held in the Armory, at 16th Street and Michigan Avenue, around the corner from the Coliseum. Dinner tickets may be obtained at the Chicago Section Lounge, Booth No. 400, or in advance at the Chicago Section ACS office, 35 East Wacker Drive, Chicago 1, Illinois.

FRIDAY AFTERNOON, October 15—2 p.m.
Frontiers of Chemistry
CHAIRMAN, Charles A. Thomas
Monsanto Chemical Company
"Synthetic Fuels"
R. C. Gunness, Standard Oil Company (Indiana)
"Chemistry in Agriculture"
L. B. Howard, U. S. Department of Agriculture
"Medicinal Chemicals" *E. H. Volwiler, Abbott Laboratories*
"Nucleonics" *Farrington Daniels, University of Wisconsin*

FRIDAY EVENING, October 15—7:30 p.m.
Pilot Plant Use by the Chemical Industry
Chairman, J. R. RUSHTON
Illinois Institute of Technology
"Synthetic Organic Chemicals"
R. B. Semple, Monsanto Chemical Company
"Development of Chemicals for the Pharmaceutical Industry"
W. H. Engels, Merck & Co., Inc.
"Petroleum Products"
N. Fragen, Standard Oil Company (Indiana)

CHICAGO SECTION LOUNGE

CHEMICAL TRAIL BLAZERS—is a new educational exhibit feature of the Exposition. It provides a novel medium for the realistic presentation of research accomplishments and other facts through the use of standardized panel exhibits. This proved to be a very popular feature at the previous Expositions, and the large number of entries indicates an even better display than the past ones.

UNITED STATES DEPARTMENT OF AGRICULTURE—The four regional research laboratories are cooperating in an extensive display of their work in the utilization of farm products. *Northern*—(a) Ground corn cobs—Soft Grit blasting material; (b) Waterproof plywood glue; (c) Starch and gluten from wheat flour; (d) Penicillin. *Eastern*—(a) Production of rutin from buckwheat; (b) Casein bristle; (c) Leaf wastes of the vegetable industry; (d) The manufacture of apple essence and some of its uses. *Southern*—(a) New Cottonseed Products by Solvent Method; (b) Sarelon—Peanut Protein Fiber; (c) Dye Test Shows "Immature" Cotton. *Western*—(a) Subtilin—A New Antibiotic; (b) Ascorbic Acid—Recovered from Waste Walnut Hulls; (c) Pectin production and uses; (d) Products from waste poultry feathers and other Keratin Materials; (e) Dehydrofreezing—A new Food Processing Method; (f) Frozen Food Research.

SPECIAL LIBRARIES—This exhibit is being presented by the Special Libraries Association, and will indicate how specialized libraries contribute to the success and speed of research work.

SPECIAL EXHIBITS

PLANT TRIPS—A list of plants having guide services, together with a map showing their location and how to get there, will be on display in Booth No. 400.

LITERATURE FILE—A file containing one of each piece of literature available at exhibitors' booths will be open to those with special search problems in the Lounge (Booth No. 400). This will supplement the one in the Technical Bureau.

NATIONAL CHEMICAL EXPOSITION

PRODUCT CLASSIFICATION OF EXHIBITORS

WITH BOOTH NUMBERS

1948 NATIONAL CHEMICAL EXPOSITION

ABRASIVES
Eimer & Amend (20)
Fisher Scientific Co. (20)

ABSORBENTS
Carbide and Carbon Chemicals Corporation (355–356)
Eimer & Amend (20)
Fisher Scientific Co. (20)
Socony-Vacuum Oil Company, Inc. (49)
Victor Chemical Works (53–54–55, 62–63–64)

ABSORBERS
Blaw-Knox Company (365–366)
Carbide and Carbon Chemicals Corporation (355–356)
Fansteel Metallurgical Corporation (137)
General Ceramics and Steatite Corporation (114)
Haveg Corporation (94)
National Carbon Co., Inc. (12–13)
The Ohio Chemical & Mfg. Co. (330)
The U. S. Stoneware Co. (40–41–42)

ACID HANDLING EQUIPMENT
Aluminum Company of America (225–226–227–228)
Barco Manufacturing Company (318)
Consolidated Products Co. Inc. (361)
Corning Glass Works (314)
F. M. deBeers & Associates (115)
Eimer & Amend (20)
Fansteel Metallurgical Corporation (137)
Fisher Scientific Co. (20)
General Ceramics and Steatite Corporation (114)
Glascote Products, Inc. (95)
Haveg Corporation (94)
Heil Process Equipment Corp. (319)
Klenzade Products, Inc. (93)
The LaBour Company, Inc. (145)
The Pioneer Rubber Company (341)
% Proportioneers, Inc. % (93)
Schaar & Co. (31)
Scientific Glass Apparatus Co. Inc. (17)
Selas Corporation of America (88–89)
Titeflex, Inc. (146)
The U. S. Stoneware Co. (40–41–42)

ACID RESISTING MATERIALS
Aluminum Company of America (225–226–227–228)
By-Products Steel Co., Division of Lukens Steel Company (9–10)
F. M. deBeers & Associates (115)
Fansteel Metallurgical Corporation (137)
General Ceramics and Steatite Corporation (114)
Glascote Products, Inc. (95)
Haveg Corporation (94)
Heil Process Equipment Corp. (319)
Hercules Powder Company (36–37)
Lukens Steel Company and Divisions (9–10)
Lukenweld, Division of Lukens Steel Company (9–10)
National Carbon Co., Inc. (12–13)
Socony-Vacuum Oil Company, Inc. (49)
Standard Safety Equipment Company (345)
Tri-Clover Machine Co. (106)
The U. S. Stoneware Co. (40–41–42)

ACIDS, Inorganic
American Cyanamid Company (347)
The Davison Chemical Corporation (59–60)
Eimer & Amend (20)
Fisher Scientific Co. (20)
Hercules Powder Company (36–37)
The Matheson Co., Inc. (131)
Schaar & Co. (31)
Victor Chemical Works (53–54–55, 62–63–64)

ACIDS, Organic
Armour Chemical Division, Armour and Company (47)
Carbide and Carbon Chemicals Corporation (355–356)
Commercial Solvents Corporation (147)
Eimer & Amend (20)
Emery Industries, Inc. (363–364)
Fisher Scientific Co. (20)
Hercules Powder Company (36–37)
The Matheson Co., Inc. (131)
Oronite Chemical Company (45)
Schaar & Co. (31)
Victor Chemical Works (53–54–55, 62–63–64)

ACRYLONITRILE
American Cyanamid Company (347)
The Matheson Co., Inc. (131)

ADHESIVES
Carbide and Carbon Chemicals Corporation (355–356)
F. M. deBeers & Associates (115)
Reichhold Chemicals, Inc. (76–77)
The U. S. Stoneware Co. (40–41–42)

AIR CONDITIONING EQUIPMENT
American Air Filter Company Inc. (307–308–309)
Barco Manufacturing Company (318)
F. M. deBeers & Associates (115)
Micro Metallic Corp. (90)

ALCOHOLS
Carbide and Carbon Chemicals Corporation (355–356)
Commercial Solvents Corporation (147)
The Matheson Co., Inc. (131)
Schaar & Co. (31)
Standard Oil Company (Indiana) Chemical Products Department (72–73)

ALCOHOLS, Polyhydric
Atlas Powder Company (126)
Carbide and Carbon Chemicals Corporation (355–356)
Glyco Products Co., Inc. (48)
The Matheson Co., Inc. (131)

ALKALIES
American Cyanamid Company (347)

ALLOYS, Ferrous
By-Products Steel Co., Division of Lukens Steel Company (9–10)
Lukens Steel Company and Divisions (9–10)
Lukenweld, Division of Lukens Steel Company (9–10)

ALLOYS, Non-Ferrous
Fansteel Metallurgical Corporation (137)
Tri-Clover Machine Co. (106)

ALUMINUM AND ALLOYS
Aluminum Company of America (225–226–227–228)

AMIDES
Alrose Chemical Company (313)
Armour Chemical Division, Armour and Company (47)
Carbide and Carbon Chemicals Corporation (355–356)
The Matheson Co., Inc. (131)

AMINES
Alrose Chemical Company (313)
Armour Chemical Division, Armour and Company (47)
Carbide and Carbon Chemicals Corporation (355–356)
Commercial Solvents Corporation (147)
The Matheson Co., Inc. (131)

AMINO ACIDS
Alrose Chemical Company (313)
The Matheson Co., Inc. (131)

AMMONIA
Commercial Solvents Corporation (147)
The Matheson Co., Inc. (131)

ANALYTICAL REAGENTS
Central Scientific Company (58)
Eimer & Amend (20)
Fisher Scientific Co. (20)
The Matheson Co., Inc. (131)
Pfaltz & Bauer, Inc. (362)
E. H. Sargent & Company (125)
Schaar & Co. (31)
Scientific Glass Apparatus Co. Inc. (17)
W. M. Welch Scientific Co. (129)

ANODES
Aluminum Company of America (225–226–227–228)
Heil Process Equipment Corp. (319)
Schaar & Co. (31)
The U. S. Stoneware Co. (40–41–42)

ANTIOXIDANTS
Alrose Chemical Company (313)
Hercules Powder Company (36–37)
Socony-Vacuum Oil Company, Inc. (49)

AROMATICS
Anderson-Prichard Oil Corporation (331)
The Matheson Co., Inc. (131)
Socony-Vacuum Oil Company, Inc. (49)
Standard Oil Company (Indiana) Chemical Products Department (72–73)

AROMATICS—Heavy
Socony-Vacuum Oil Company, Inc. (49)
Standard Oil Company (Indiana) Chemical Products Department (72–73)

(Continued on page 388)

Compiled from information supplied to the Chemical Exposition Management. No responsibility assumed for errors or omissions.

BUFLOVAK

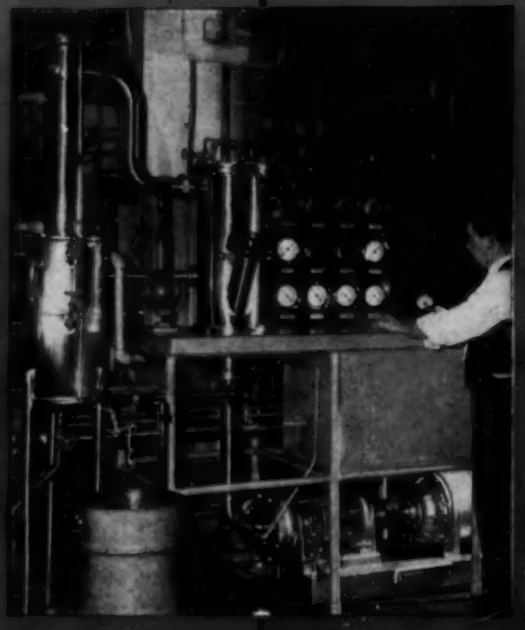
BRINGS ITS CHEMICAL PROCESSING EQUIPMENT TO YOU... AT THE

5th CHEMICAL EXPOSITION

COLISEUM • CHICAGO
OCTOBER 12-16, 1948

BOOTH 303·4·5

YOU ARE CORDIALLY INVITED TO SEE FOR YOURSELF HOW BUFLOVAK Pilot Plant Equipment is Designed... Operates!



Illustrated is a BUFLOVAK Forced Circulation Evaporator which you will see at the 5th Chemical Exposition at Chicago, along with other Pilot Plant equipment borrowed from our Research Laboratory and Testing Plant.

Have you a chemical or food processing problem? We cordially invite you to stop at our booth and become acquainted with BUFLOVAK'S facilities for ironing out such problems.

BUFLOVAK offers you the most modern in Evaporators, Dryers, Solvent Recovery and Distillation Equipment, Castings, Chemical and Food Processing Equipment, and Vulcanizers.

Don't forget—Booth 303-4-5 is yours. Pay us a visit!

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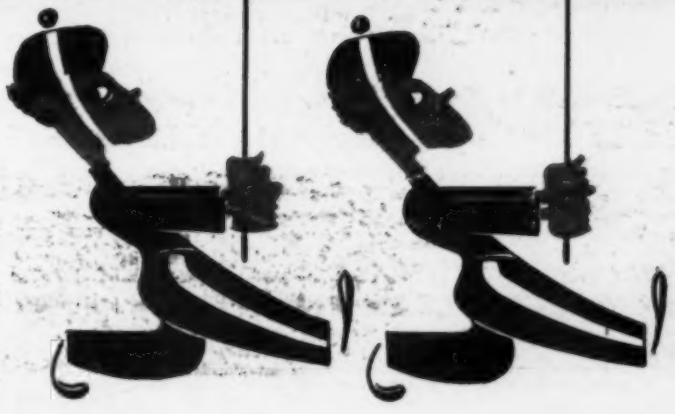

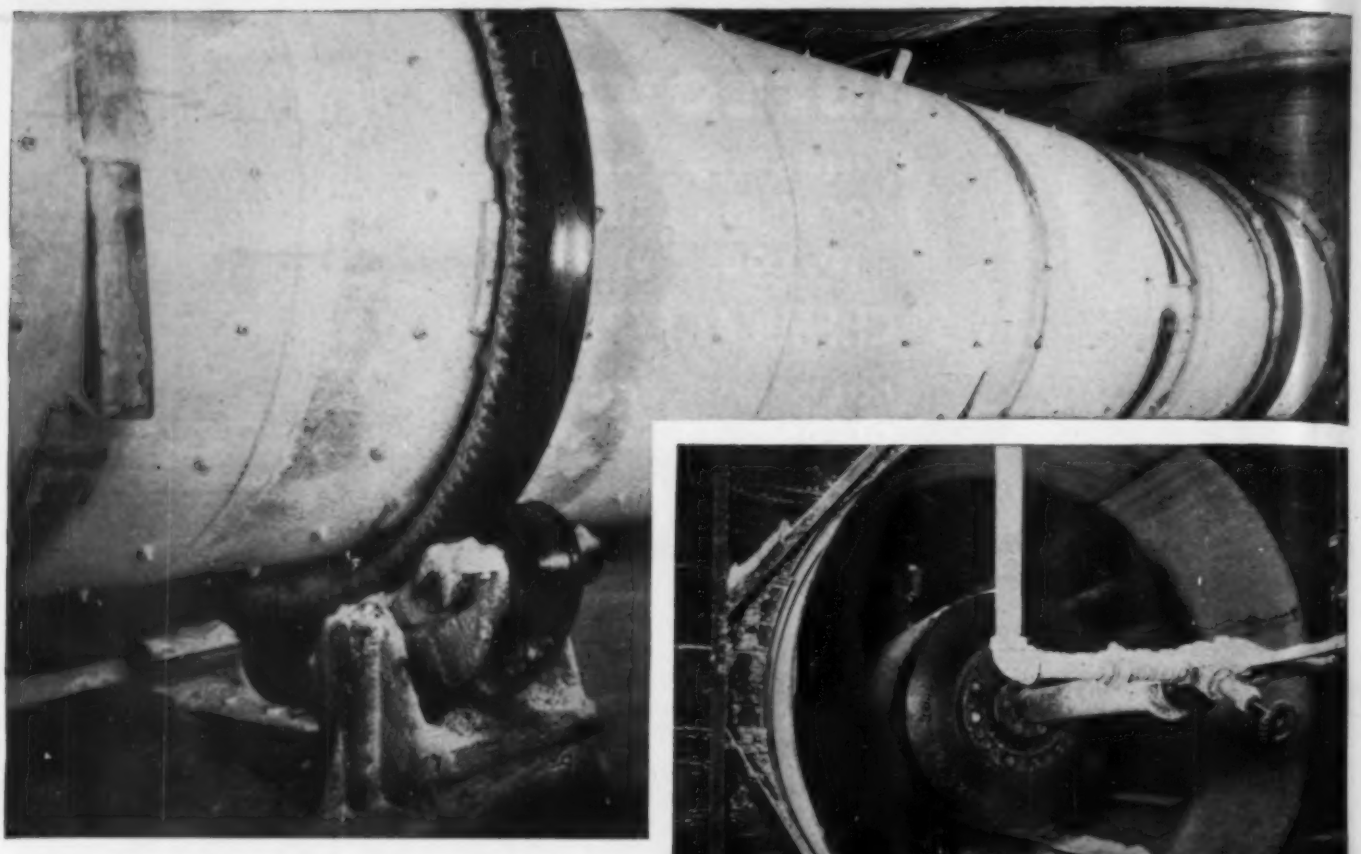

Lukens 20% Nickel-Clad Steel forms the shell of this rotary salt drier at Colonial Salt Company's Akron, Ohio, plant.

"NO RED SALT" from this Nickel-Clad Drier

"Installed March 5, 1937" is written on the head of this cylinder, evidence that the engineers at Colonial Salt Company meant to keep their eyes on the performance of this nickel-clad equipment. Recent examination of its interior shows the surface unattacked by the moist salt which continually tumbles through it.

"No red salt" is the plant engineer's way of reporting that there's no rusting to contaminate the salt. Only nickel is exposed to the salt because Lukens Nickel-Clad Steel has a uniform thickness of nickel cladding permanently bonded to the steel backing plate.

If nickel answers *your* corrosion problem—or stainless steel, Inconel or Monel—you also can get this *solid* metal protection at the lower cost of *clad* steel. Lukens Nickel-Clad, Stainless-Clad, Inconel-Clad and Monel-Clad Steels are available in plates as wide as 178″ or over 3″ thick.

Bulletins 255 and 338 give you data on Lukens Clad Steels. For copies, write Lukens Steel Company, 400 Lukens Bldg., Coatesville, Pennsylvania.

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Booths 9 and 10
The National Chemical Exposition
Chicago Coliseum
October 12 thru 16

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Booth 320
National Metal Exposition
Convention Hall, Philadelphia
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STEELS

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U.S.I. CHEMICAL NEWS

September ★ A Monthly Series for Chemists and Executives of the Solvents and Chemical Consuming Industries ★ 1948

William P. Marsh, Jr. Is Newly Elected President of U.S.I.

Succeeds Glenn L. Haskell Who Becomes Vice Chairman of Board

William P. Marsh, Jr., executive vice president, has been elected president of U. S. Industrial Chemicals, Inc. He succeeds Glenn L. Haskell who is retiring and becomes vice chairman of the Board of Directors.

New president of U.S.I.
WILLIAM P. MARSH, JR.

Mr. Marsh joined U. S. Industrial Chemicals in 1937, was elected a vice president in 1943, a director in 1947, and has been executive vice president since the first of this year. Mr. Marsh was graduated from Yale in 1930. He is a member of the New York State Society

Retiring president of U.S.I.
GLENN L. HASKELL

of Certified Public Accountants and of the Controllers Institute.

Mr. Haskell became associated with the company in 1921 when it was known as The U. S. Industrial Alcohol Co. He became a director in 1934 and president in 1943.

THE AMERICAN HYDROCARBON SYNTHESIS: IX

American Hydrocarbon Synthesis Is New Source of Aldehydes

Acetaldehyde, Propionaldehyde, and Butyraldehyde Available Commercially From Single Process For First Time

The American Hydrocarbon Synthesis will soon provide the chemical industry with commercial quantities of three important aldehydes — acetaldehyde, propionaldehyde, and butyraldehyde. For the first time these versatile chemicals, whose characteristic reactivity makes them useful as raw materials and intermediates in a wide range of processes, will be available from a single source.

Aldehydes Widely Used

A great variety of acids, alcohols, and intermediates can be produced by the various oxidation, reduction, and condensation reactions into which aldehydes enter. Acetaldehyde is a raw material for the manufacture of acetic acid. It is also used in the production of acetic anhydride by a carefully controlled catalytic reaction in which peracetic acid is an unstable intermediate. In addition, synthetic butanol, polyvinyl acetal, and a number of resinous materials are produced from acetaldehyde.

Safety glass takes punishment in a standard test. The polyvinyl butyral inner layer of safety glass is one of many products made from butyraldehyde — a raw material and intermediate which the American Hydrocarbon Synthesis will soon make more readily available.

A less well known but nevertheless important use of acetaldehyde is in the preparation of rubber accelerators and antioxidants by condensation with aromatic amines. Pentaerythritol, used in wartime for explosives and in peacetime for resin production — and ethyl acetate, an important commercial solvent — can be prepared from acetaldehyde.

Butyraldehyde is used in the manufacture of butyric acid, and of polyvinyl butyral — found in safety-glass inner layers. Reduction of butyraldehyde yields the corresponding alcohol, butanol. 2-ethyl hexanol also can be prepared from butyraldehyde by the aldol condensation reaction.

It is highly probable that the increase in the availability of propionaldehyde resulting

MORE

Deafness Treated By Vitamins and Amino Acids

A new method for treating acoustic disorders, described in a recent scientific report, makes use of high dosages of vitamins and amino acids. The authors of the report believe that vitamins, in combination with protein and amino acids, catalyze many vital body reactions and bear an important relationship to the enzymes facilitating metabolic transformations. Among the amino acids employed is DL-methionine, a product of U.S.I.

Of a group of 78 patients treated for acoustic disorders by this method of combined vitamins and amino acids, 57 were reported as showing improvement. The favorable results were said to be especially reflected in gains of perception of high tones.

Recognizing the fact that deafness can be the result of any of a large number of different causes, the trial tests of this treatment seem to indicate that vitamin and amino acid therapy may produce an increase in threshold perception and in acoustic range in certain individuals.

Spinning Balls Test Adhesiveness Of Paint

Steel balls, a quarter inch in diameter, spinning at a speed of approximately 600 miles an hour, are being used to test the ability of paints to stick to a surface. The method, developed recently, has just been reported.

Dots of paint are put on the balls (which spin in an ultracentrifuge at a top speed of 2,400,000 revolutions per minute). The balls are suspended in a vacuum and driven by a rotating magnetic field. When the balls spin in the ultra-centrifuge, the dots of paint fly off, and the speed at which this takes place is used to calculate the adhesive qualities of the paint under test.

Improves Foam Control

An improvement in apparatus for the retarding of foam and froth formation in boilers and pressure vessels is described in a recent patent. It consists of an overhanging partitioning member having vertical intake passages and laterally-directed upper discharges with restricted outlets.

ADVERTISEMENT—*This entire page is a paid advertisement*

September ★ **U.S.I. CHEMICAL NEWS** ★ 1948

New Process Improves Brightness of Magnesium

Bright metallic finishing of magnesium, long awaited by manufacturers who want a scratch-resistant and durable bright metallic finish for the light metal, is now available for commercial production, it was announced recently. Automotive parts, cameras, home appliances, hardware, and many other products can now be made in magnesium and electro-plated with chromium, nickel, or other hard bright surfaces.

Key to success of the process, which has been under development for several years, is the application of a thin zinc coating to the magnesium part by simple immersion in a pyrophosphate zinc solution. Thereafter, standard electroplating procedure is used.

CONTINUED New Source Of Aldehydes

from the American Hydrocarbon Synthesis will act as a stimulus to the development of new uses for this chemical. Propionaldehyde has properties midway between those of acetaldehyde and butyraldehyde. Present uses for polyvinyl acetal and polyvinyl butyral suggest that polyvinyl propional might likewise prove to be a valuable product. Higher alcohols from propionaldehyde also represent a promising field.

Previous Sources

Justus von Liebig, working in his university laboratory at Giessen, Germany, first isolated and investigated acetaldehyde in the year 1835. He called it *alcohol dehydrogenatum* — and up to now the dehydrogenation (oxidation) of alcohols has been important in the preparation of aldehydes. Acetaldehyde has been produced commercially by the catalytic hydration of acetylene and both acetaldehyde and propionaldehyde by the oxidation of petroleum gases.

Now, however, for the first time, three lower aldehydes — acetaldehyde, propionaldehyde, and butyraldehyde — will be available from a single basic operation, with quality assured by the high standards maintained by U. S. Industrial Chemicals, Inc. With such a consolidated competitive source of supply a nearby reality, many new and challenging opportunities await the producers who use aldehydes as raw materials and intermediates.

Polyvinyl Chloride Parts Now Joined By 'Welding'

The joining of plasticized polyvinyl chloride parts by welding is widely practiced in Germany, according to a report now available. Welding is preferred to adhesive binding since it results in a virtually continuous material. Investigators say one of the secrets of German success is the use of as hot a blast of air as possible to obtain quick local melting of the surface without deep penetration, and the application of firm pressure with a roller. Confining the heat to the surface permits rapid cooling, making the maintenance of pressure over long periods unnecessary.

ATTENTION

Users Of Specially Denatured Alcohol

Now is the time to renew your basic permit (Treasury Department Form 1479) for 1949. If you require forms or any assistance in their preparation, please call your nearest U.S.I. office.

Plastics Handbook Ready

Reflecting the four years spent in the preparation of this book for the plastics industries, the *S.P.I. Handbook* is now available as an authoritative source of information on plastics. The eleven chapters, covering 430 pages, treat the subject with detail and precision, from the classification of materials to the finishing and assembling operations. The book contains over five hundred charts and illustrations.

TECHNICAL DEVELOPMENTS

Further information regarding the manufacturers of these items may be obtained by writing U.S.I.

A new nylon floor covering, claimed to be nonflammable, can be cleaned easily with soap and water, the makers state. **(No. 360)**

A new liquid rust remover is said to remove even the thickest coat from iron, steel, copper, brass, bronze and other metals. Application is by paint brush or cotton swab. **(No. 361)**

A new acid-resistant coating is said to be useful for coating metals to resist all types of inorganic solutions, particularly plating solutions. Resistance to attack or absorption by chromic acid is claimed to be an outstanding feature. **(No. 362)**

A new fusion oven, designed for use in curing plastic coatings, can use either gas or electricity as a heating medium, it is stated. **(No. 363)**

An electronic color analyzer, alleged to be so sensitive that it will detect color differences too small to be seen by the average human eye, has been designed for photographic work. It is also claimed to be adaptable to measuring or matching colors in textiles and in paints and dyes. **(No. 364)**

A non-curling adhesive plaster, said to offer greater freedom from skin irritations, does not creep or curl at the edges, the makers state. **(No. 365)**

A low-cost diluent for insecticides, described as having a low grit content to reduce abrasion on pipes and nozzles, is said to permit unusually effective dispersion of the active ingredients. **(No. 366)**

A new one-coat silicone waterproofing, applied to the exterior of brick, concrete, stucco, or cinder block, is claimed to make them lastingly and completely water-repellent and stain-proof. **(No. 367)**

White leather that stays white has been announced. It is claimed to be exceptionally soft and to be readily washed or dry-cleaned. **(No. 368)**

A new starch product, said to have unusual clarity and stability, gelatinizes with extreme sharpness and at considerably lower temperatures than ordinary starches, the manufacturers claim. **(No. 369)**

An improved supersonic testing instrument, said to be about one-half the size of models now in use, is described as particularly valuable for field testing welds in tanks, pipe, and various structures. **(No. 370)**

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Amyl Alcohol
Butanol (Normal Butyl Alcohol)
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Specially Denatured—all regular and anhydrous formulas
Completely Denatured—all regular and anhydrous formulas
Pure—190 proof, C.P. 96% Absolute
*Super Pyro Anti-freeze
*Solox proprietary Solvent

***ANSOLS**
Ansol M
Ansol PR

ACETIC ESTERS
Amyl Acetate
Butyl Acetate
Ethyl Acetate

OXALIC ESTERS
Dibutyl Oxalate
Diethyl Oxalate

PHTHALIC ESTERS
Diamyl Phthalate
Dibutyl Phthalate
Diethyl Phthalate

OTHER ESTERS
*Diatol
Diethyl Carbonate
Ethyl Chloroformate

INTERMEDIATES
Acetoacetanilide
Acetoacet-ortho-anisidide
Acetoacet-ortho-chloroanilide
Acetoacet-ortho-toluidide
Acetoacet-para-chloroanilide
Ethyl Acetoacetate
Ethyl Benzoylacetate
Ethyl Sodiumoxalacetate

ETHERS
Ethyl Ether
Ethyl Ether Absolute—A.C.S.

FEED CONCENTRATES
Riboflavin Concentrates *Vacatone 40
*Curbay B-G *Special Liquid Curbay

ACETONE
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RESINS (Synthetic and Natural)
*Aroplaz—alkyds and allied materials
*Arofene—pure phenolics
*Arochem—modified types
Ester Gums—all types
Congo Gums—raw, fused & esterified
Natural Resins—all standard grades

INSECTICIDE MATERIALS
*Pyrenone Concentrates
Pyrethrum Products
Rotenone Products

INSECTIFUGE MATERIALS
*Indalone
*Dimelone
Triple-Mix Repellents

OTHER PRODUCTS
Collodions Urethane, U.S.P.
Nitrocellulose Solutions DL-Methionine
Ethylene

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tantalum

Chemical Processing Equipment

TRUE ECONOMY
from every angle

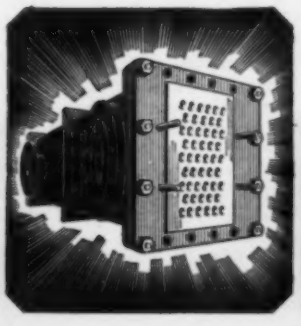
Tantalum condensers are noted for high efficiency in small space. One square foot of tantalum often transfers as much heat as 18 to 20 square feet of non-metallic area.

The outstanding economy of Tantalum acid-proof equipment is in its complete freedom from corrosion and contamination, its remarkably high efficiency in heat transfer operations, its long life in continuous service with freedom from shutdowns, interruptions, replacements and repairs.

Tantalum heaters, coolers, condensers, evaporators, HCl plants and distillation and recovery units have proved their economy throughout the world. Initial costs are not as high as you might think, overall costs are suprisingly low. Consult on your corrosion problems with Fansteel Metallurgical Corporation, North Chicago, Illinois.

USE TANTALUM WITH ECONOMY

For most acid solutions and corrosive gases or vapors, except HF, alkalis, or substances containing free SO_3



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Acid-Proof
TANTALUM
CHEMICAL PLANT EQUIPMENT

No "Steel Shortage"

In Kewaunee's new heavier metal construction

Right now you might expect a swing to lighter construction to save metal. But Kewaunee won't operate that way. Instead we announce a new *heavier metal construction*. Every piece is ruggedly built in our own plants—made to stand up for extra years—and to bring your technicians every "speed-up" convenience. All metal bonderized for protection against chipping, rusting, and corrosion. All working surfaces of Kemrock defiantly resistant to abrasives, acids, alkalies, solvents, and thermal shocks.

Visit the Kewaunee Exhibit at the National Chemical Exposition Chicago Coliseum, October 12-16 · Booths 104 and 105

See for yourself Kewaunee's superior new construction. Note how smoothly drawers operate. And look—an average man can swing on a Kewaunee cabinet door without causing sag or injuring the hinges. Yes—be sure to see Kewaunee's new heavier metal construction at the show or write for Kewaunee's latest catalog of Laboratory Furniture.

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Representatives in Principal Cities

EXHIBITORS • Classified by Products • CONTINUED

ASBESTOS
Eimer & Amend (20)
Fisher Scientific Co. (20)
Haveg Corporation (94)
Hercules Filter Corporation (117)

AUTOCLAVES, Industrial
Blaw-Knox Company (365–366)
Buflovak Equipment Division of Blaw-Knox Co. (303–304–305)
Consolidated Products Co. Inc. (361)
Hercules Filter Corporation (117)

BLOWERS—See Fans

BOOKS, Technical
Encyclopedia Britannica (202)
The Miskella *Infra-Red* Company (128)
Reinhold Publishing Corporation (18–19)

BOTTLING EQUIPMENT—See Packaging Equipment

CALCINERS
Consolidated Products Co. Inc. (361)

CARBON
National Carbon Co., Inc. (12–13)

CARBON, Activated
Carbide and Carbon Chemicals Corporation (355–356)
The Filter Paper Company (121–122)
Infilco Inc. (134)
National Carbon Co., Inc. (12–13)

CARBON—Tubing and Shapes
General Ceramics and Steatite Corporation (114)
National Carbon Co., Inc. (12–13)
United States Steel Corp. (336)

CASEIN AND DERIVATIVES
American Cyanamid Company (347)
Hercules Powder Company (36–37)
The Matheson Co., Inc. (131)

CASTINGS
Aluminum Company of America (225–226–227–228)
Buflovak Equipment Division of Blaw-Knox Co. (303–304–305)
F. M. deBeers & Associates (115)
Haveg Corporation (94)
Homestead Valve Manufacturing Co. (324)

CATALYSTS
Aluminum Company of America (225–226–227–228)
The Davison Chemical Corporation (59–60)
The Matheson Co., Inc. (131)
National Aluminate Corporation (335)
Oronite Chemical Company (45)
Socony-Vacuum Oil Company, Inc. (49)

CELLULOSE AND DERIVATIVES
Carbide and Carbon Chemicals Corporation (355–356)
Hercules Powder Company (36–37)

CEMENT
Haveg Corporation (94)
National Carbon Co., Inc. (12–13)
The U. S. Stoneware Co. (40–41–42)
United States Steel Corp. (336)

CENTRIFUGALS, Industrial
Chicago Apparatus Company (135)
Consolidated Products Co. Inc. (361)
F. M. deBeers & Associates (115)
The DeLaval Separator Company (203)
The LaBour Company, Inc. (145)
Loeb Equipment Supply Co. (91–92)

CERAMIC AND PORCELAIN EQUIPMENT, Industrial
American Machine & Foundry Company (359–360)
Consolidated Products Co. Inc. (361)
F. M. deBeers & Associates (115)
General Ceramics and Steatite Corporation (114)
Glascote Products, Inc. (95)
J. W. Greer Company (301–302)
Illinois Water Treatment Co. (8)
Laboratory Equipment Corporation (119)
National Engineering Company (132–133)
Selas Corporation of America (88–89)
The U. S. Stoneware Co. (40–41–42)

CHEMICAL ENGINEERS
Buflovak Equipment Division of Blaw-Knox Co. (303–304–305)
F. M. deBeers & Associates (115)
Illinois Water Treatment Co. (8)
National Engineering Company (132–133)
Tri-Clover Machine Co. (106)

CHEMICAL PLANT EQUIPMENT
Aluminum Company of America (225–226–227–228)
American Cyanamid Company (347)
Blaw-Knox Company (365–366)
Buflovak Equipment Division of Blaw-Knox Co. (303–304–305)
By-Products Steel Co., Division of Lukens Steel Company (9–10)
Arthur Colton Company (210)
Consolidated Products Co. Inc. (361)
The Cowles Co. (217–218)
The J. H. Day Company (229)
F. M. deBeers & Associates (115)
Defiance Machine Works, Inc. (211)
The DeLaval Separator Company (203)
Denver Equipment Company (83)
Dings Magnetic Separator Co. (118)
The Eimco Corporation (320–321–322)
Eriez Manufacturing Company (358)
Fansteel Metallurgical Corporation (137)
The Filter Paper Company (121–122)
General Ceramics and Steatite Corporation (114)
Glascote Products, Inc. (95)
J. W. Greer Company (301–302)
Groen Mfg. Co. (33–34–35)
B. F. Gump Co. (22–23)
Hasco Value & Mach Co. (108)
Haveg Corporation (94)
Hercules Filter Corporation (117)
Klenzade Products, Inc. (93)
Loeb Equipment Supply Co. (91–92)
The Ludlow-Saylor Wire Company (343)
Lukens Steel Company and Division (9–10)
Lukenweld, Division of Lukens Steel Company (9–10)
Micro Metallic Corp. (90)
National Engineering Company (132–133)
% Proportioneers, Inc. % (93)
Rockwell Manufacturing Co., Hydraulics Division (97)
Selas Corporation of America (88–89)
Tri-Clover Machine Co. (106)
The U. S. Stoneware Co. (40–41–42)
Wallace & Tiernan Products, Inc. (342)

(*Continued on page 390*)

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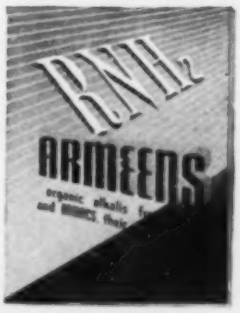
ARMOUR'S "CHEMICALS FROM FATS"

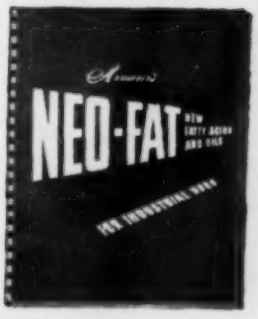


NAME: ARMEENS

Also known as aliphatic amines and their partners the Armacs (amine acetate salts). Wanted for: ore flotation reagents, quaternary salt germicides, cationic emulsification, asphalt bonding, pigment grinding, synthetic detergents, repellents and penetrants. Ask for the useful booklet "RNH_2 . . . Armeens and Armacs."

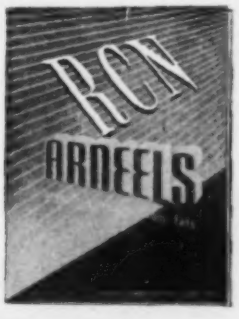
NAME: ARQUADS

Also referred to as Armour's alkyl trimethyl ammonium chloride compounds. Wanted for these uses: germicides, cationic textile softeners, ore flotation reagents, anti-static polishes for waxes, emulsifying agents, detergents and alkaline cleaning compounds. You'll want the booklet "$RN(CH_3)_3Cl$ . . . Arquads."



NAME: NEO-FATS

These pure fatty acids, made possible by Armour's patented fractional distillation process, are wanted for: protective coatings, soaps and detergents, rubber compounding, lubricating greases, cosmetics, and chemical intermediates. The helpful booklet "Neo-Fats" gives you more detailed, instructive information.



NAME: ARNEELS

Also called Armour's aliphatic nitriles. Wanted as: lubrication assistants for textiles, water-proofing compounds, softeners for certain synthetic rubbers or elastoprenes and synthetic rubber-like elastics or elastoplastics. Read valuable booklet "RCN . . . Arneels."

NAME: ARMIDS

Alias Armour's aliphatic amides. Wanted for these uses: "all-weather" anti-scratch materials for printing inks, emulsion stabilizers and thickeners, dye solubilizers for carbon paper, anti-blocks for plastics. Ask for the informative booklet "$RCONH_2$... Armids."

For bulletins, samples or additional information on any of these chemicals,

VISIT BOOTH 47
NATIONAL CHEMICAL EXPOSITION
CHICAGO COLISEUM,
OCT. 12-16, 1948

ARMOUR *Chemical* DIVISION
1355 West 31st Street • Chicago 9, Illinois

EXHIBITORS • Classified by Products • CONTINUED

CHEMICAL RESEARCH
Battelle Memorial Institute (348)
W. H. Kessel & Co. (120)
Schaar & Co. (31)

CHEMICALS FROM FATS
Armour Chemical Division, Armour and Company (47)
Hercules Powder Company (36–37)

CHEMICALS, Fine
Mallinckrodt Chemical Works (86)

CHEMICALS, Food
Alrose Chemical Company (313)
Atlas Powder Company (126)
Carbide and Carbon Chemicals Corporation (355–356)
Chemical Industries Magazine (66–67)
Glyco Products Co., Inc. (68)
Maclean-Hunter Publishing Corp. (66–67)
Mallinckrodt Chemical Works (86)
Tri-Clover Machine Co. (106)
Victor Chemical Works (53–54–55, 62–63–64)

CHEMICALS, Industrial-Inorganic
American Cyanamid Company (347)
Ansul Chemical Company (39)
Chemical Industries Magazine (66–67)
Commercial Solvents Corporation (147)
The Davison Chemical Corporation (59–60)
Hercules Powder Company (36–37)
Maclean-Hunter Publishing Corp. (66–67)
Mallinckrodt Chemical Works (86)
The Matheson Co., Inc. (131)
Victor Chemical Works (53–54–55, 62–63–64)

CHEMICALS, Industrial-Organic
Alrose Chemical Company (313)
American Cyanamid Company (347)
Ansul Chemical Company (39)
Armour Chemical Division, Armour and Company (47)
Atlas Powder Company (126)
Carbide and Carbon Chemicals Corporation (355–356)
Chemical Industries Magazine (66–67)
Commercial Solvents Corporation (147)
Emery Industries, Inc. (363–364)
Glyco Products Co., Inc. (68)
Hercules Powder Company (36–37)
Maclean-Hunter Publishing Corp. (66–67)
Mallinckrodt Chemical Works (86)
The Matheson Co., Inc. (131)
Socony-Vacuum Oil Company, Inc. (49)
Victor Chemical Works (53–54–55, 62–63–64)

CHEMICALS, Laboratory
Chemical Industries Magazine (66–67)
Eimer & Amend (20)
Fisher Scientific Co. (20)
Arthur S. LaPine & Company (21)
Maclean-Hunter Publishing Corp. (66–67)
Mallinckrodt Chemical Works (86)
The Matheson Co., Inc. (131)
Pfaltz & Bauer, Inc. (362)
E. H. Sargent & Company (125)
Schaar & Co. (31)
Scientific Glass Apparatus Co. Inc. (17)
W. M. Welch Scientific Co. (129)

CHEMICALS, Leather
American Cyanamid Company (347)
Ansul Chemical Company (39)
Carbide and Carbon Chemicals Corporation (355–356)
Chemical Industries Magazine (66–67)
Hercules Powder Company (36–37)
Maclean-Hunter Publishing Corp. (66–67)
Pfaltz & Bauer, Inc. (362)
L. Sonneborn Sons, Inc. (38)
Victor Chemical Works (53–54–55, 62–63–64)

CHEMICALS, Paint
American Cyanamid Company (347)
Atlas Powder Company (126)
Carbide and Carbon Chemicals Corporation (355–356)
Chemical Industries Magazine (66–67)
Glyco Products Co., Inc. (68)
Hercules Powder Company (36–37)
Maclean-Hunter Publishing Corp. (66–67)
Plastic Lining Corporation (220)
Victor Chemical Works (53–54–55, 62–63–64)

CHEMICALS, Pharmaceutical
Alrose Chemical Company (313)
American Cyanamid Company (347)
Atlas Powder Company (126)
Carbide and Carbon Chemicals Corporation (355–356)
Chemical Industries Magazine (66–67)
Commercial Solvents Corporation (147)
Eimer & Amend (20)
Fisher Scientific Co. (20)
Glyco Products Co., Inc. (68)
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Maclean-Hunter Publishing Corp. (66–67)
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L. Sonneborn Sons, Inc. (38)
Victor Chemical Works (53–54–55, 62–63–64)

CHEMICALS, Photographic
American Cyanamid Company (347)
Carbide and Carbon Chemicals Corporation (355–356)
Chemical Industries Magazine (66–67)
Hercules Powder Company (36–37)
Arthur S. LaPine & Company (21)
Maclean-Hunter Publishing Corp. (66–67)
Mallinckrodt Chemical Works (86)
Victor Chemical Works (53–54–55, 62–63–64)

CHEMICALS, Plastics
American Cyanamid Company (347)
Armour Chemical Division, Armour and Company (47)
Carbide and Carbon Chemicals Corporation (355–356)
Chemical Industries Magazine (66–67)
Commercial Solvents Corporation (147)
Glyco Products Co., Inc. (68)
Haveg Corporation (94)
Hercules Powder Company (36–37)
Maclean-Hunter Publishing Corp. (66–67)
L. Sonneborn Sons, Inc. (38)
Victor Chemical Works (53–54–55, 62–63–64)

CHEMICALS, Textile
Alrose Chemical Company (313)
American Cyanamid Company (347)
Armour Chemical Division, Armour and Company (47)
Atlas Powder Company (126)
Carbide and Carbon Chemicals Corporation (355–356)
Chemical Industries Magazine (66–67)
Emery Industries, Inc. (363–364)
Glyco Products Co., Inc. (69)
Hercules Powder Company (36–37)
Maclean-Hunter Publishing Corp. (66–67)
Oronite Chemical Company (45)
Pfaltz & Bauer, Inc. (362)
L. Sonneborn Sons, Inc. (38)
Victor Chemical Works (53–54–55, 62–63–64)

CHLORHYDRINS
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The Matheson Co., Inc. (131)

CHLORINE
The Matheson Co., Inc. (131)

CLARIFIERS
Alrose Chemical Company (313)
Consolidated Products Co. Inc. (361)
George E. Fredericks Company (206–207)
Hardinge Company, Inc. (224)
Hercules Filter Corporation (117)
Loeb Equipment Supply Co. (91–92)
Micro Metallic Corp. (90)
Niagara Filter Corporation (1–2)
Selas Corporation of America (88–89)
Selwyn Engineering Company (1–2)

CLASSIFIERS
Consolidated Products Co. Inc. (361)
Denver Equipment Company (83)
Hardinge Company, Inc. (224)

COATINGS
American Cyanamid Company (347)
Atlas Powder Company (126)
F. M. deBeers & Associates (115)
Haveg Corporation (94)
Hercules Powder Company (36–37)
The U. S. Stoneware Co. (40–41–42)

COLLOID MILLS, Industrial
Consolidated Products Co. Inc. (361)
The W. J. Fitzpatrick Co. Inc. (84–85)
Loeb Equipment Supply Co. (91–92)
Premier Mill Corporation (350)

COLORS
American Cyanamid Company (347)

COMPLETE CHEMICAL PLANTS
Blaw-Knox Company (365–366)

CONDENSERS AND COOLERS, Industrial
Aluminum Company of America (225–226–227–228)
Blaw-Knox Company (365–366)
Buflovak Equipment Division of Blaw-Knox Co. (303–304–305)
Consolidated Products Co. Inc. (361)
Enzinger Union Corp. (48)
F. M. deBeers & Associates (115)
Fansteel Metallurgical Corporation (137)
Glascote Products, Inc. (95)
Graham Manufacturing Co. Inc. (56)
Groen Mfg. Co. (33–34–35)
Haveg Corporation (94)
(Continued on page 392)

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ORONITE CHEMICAL COMPANY

REG. U. S. PAT. OFF.

THE NAME TO WATCH IN CHEMICALS

FOR BODYING AGENTS USE ORONITE POLYBUTENES

Where formulations require hydrocarbon polymers as bodying agents you'll find many advantages with Oronite Polybutenes. Their wide viscosity range permits the right degree of bodying for lubricants, hydraulic fluids, paste inks, flexible coatings and adhesives, to name a few.

They can be compounded with resins, waxes, oils and fatty acids. A few outstanding properties of Polybutenes are light color, flexibility, moisture resistance and exceptional stability.

Because there are many industrial uses for Polybutenes ...it may pay you to investigate this product today. A short list of applications are shown in the column to the right. Contact the Oronite office nearest you for more detailed information.

HERE ARE OTHER APPLICATIONS FOR POLYBUTENES

Electrical Insulation

Has high dielectric strength, low power factor, low temperature flexibility and impermeability to moisture.

Leather Treatment

Used in emulsions for softening, moisture proofing and immersion treatment.

Plasticizer

Increases flexibility and tackiness at low concentrations in waxes, resins and polymers with low polarity.

Powder Metallurgy

Improves moulding powder, withstands elevated operating temperatures. Non-charring, clean burn off.

Calking and Sealing Compounds

Soluble in raw and boiled linseed oil. Outstanding adhesion, elasticity and non-drying characteristics.

Milled Rubber Compounds

Gives decided softening action. Increases tackiness. Is inert to atmospheric oxidation.

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Formulation of waterproofing coatings where it contributes good moisture resistance, better adhesion and flexibility.

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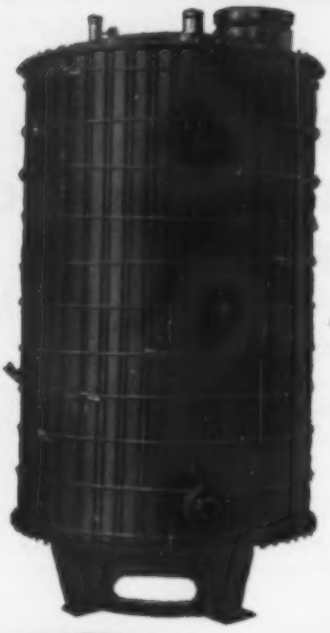
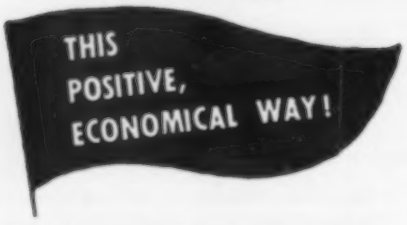
30 ROCKEFELLER PLAZA, NEW YORK 20, NEW YORK
600 S. MICHIGAN AVENUE, CHICAGO 5, ILLINOIS





If you've ever had equipment losses due to corrosion . . . if you've ever wanted a sure, economical way to solve corrosion problems . . . investigate HAVEG.

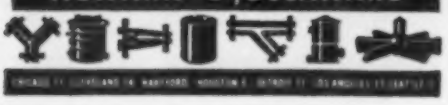
Here is a molded structural material that assures complete acid, alkali and solvent resistance *throughout its entire mass* . . . it is not just a lining or coating!

HAVEG equipment lasts longer . . . costs less. Its strength, toughness, and durability make it ideal for tanks, towers, coolers, piping, valves and similar applications. For *real* help in your fight against costly corrosion, investigate HAVEG, now.

Bulletin F-5 gives complete design, engineering and application data. Write for it today.

HA-5-48

HAVEG
CORPORATION
NEWARK 8, DELAWARE



EXHIBITORS • Classified by Products • CONTINUED

Heil Process Equipment Corp. (319)
Mojonnier Bros. Co. (326–327)
National Carbon Co., Inc. (12–13)

CONTAINERS AND PACKAGES

Aluminum Company of America (225–226–227–228)
Bagpak Division, International Paper Company (143–144)
Bemis Bro. Bag Co. (74–75)
The Container Company, Division of Continental Can Co., Inc. (43–44)
Continental Can Co., Inc., The Container Company Division (43–44)
Emery-Carpenter Container Company (136)
International Paper Company, Bagpak Division (143–144)
National Box & Lumber Company (306)
Union Bag & Paper Corporation (112–113)

CONTROLLERS AND CONTROL SYSTEMS

Arthur S. LaPine & Company (21)
Leeds & Northrup Company (357)
National Technical Laboratories (25–26)
Rockwell Manufacturing Co., Hydraulics Division (97)

COOKERS—See Digesters

COOLERS—See Condensers

CORROSION RESISTANT MATERIALS

By-Products Steel Co., Division of Lukens Steel Company (9–10)
Eastern Stainless Steel Corporation (310–311)
Fansteel Metallurgical Corporation (137)
Groen Mfg. Co. (33–34–35)
Haveg Corporation (94)
Heil Process Equipment Corp. (319)
Lukens Steel Company and Divisions (9–10)
Lukenweld, Division of Lukens Steel Company (9–10)
Plastic Lining Corporation (220)
Titeflex, Inc. (146)

CRESOLS

The Matheson Co., Inc. (131)
Oronite Chemical Company (45)

CRUSHERS, GRINDS, MILLS AND PULVERIZERS, Industrial

Combustion Engineering Company, Inc., Raymond Pulverizer Division (69)
Consolidated Products Co. Inc. (361)
Denver Equipment Company (83)
The W. J. Fitzpatrick Co. Inc. (84–85)
Hardinge Company, Inc. (224)
Loeb Equipment Supply Co. (91–92)
Raymond Pulverizer Division, Combustion Engineering Company, Inc. (69)
The U. S. Stoneware Co. (40–41–42)

DECLORIZING AND PURIFYING MATERIALS

Atlas Powder Company (126)
The Filter Paper Company (121–122)
Hercules Filter Corporation (117)
Victor Chemical Works (53–54–55, 62–63–64)

DESICCANTS

The Davison Chemical Corporation (59–60)
Socony-Vacuum Oil Company, Inc. (49)

DETERGENTS

Alrose Chemical Company (313)
Armour Chemical Division, Armour and Company (47)
Atlas Powder Company (126)
Carbide and Carbon Chemicals Corporation (355–356)
Glyco Products Co., Inc. (68)
Hercules Powder Company (36–37)
Oronite Chemical Company (45)
Socony-Vacuum Oil Company, Inc. (49)
L. Sonneborn Sons, Inc. (38)
Standard Oil Company (Indiana) Chemical Products Department (72–73)
Victor Chemical Works (53–54–55, 62–63–64)

DIGESTERS AND COOKERS

Blaw-Knox Company (365–366)
Buflovak Equipment Division of Blaw-Knox Co. (303–304–305)
Consolidated Products Co. Inc. (361)
Fansteel Metallurgical Corporation (137)
Groen Mfg. Co. (33–34–35)
Haveg Corporation (94)
Loeb Equipment Supply Co. (91–92)
Mojonnier Bros. Co. (326–327)

DISINFECTANTS AND DISINFECTANT BASES

Alrose Chemical Company (313)
Hercules Powder Company (36–37)
The Ohio Chemical & Mfg. Co. (330)
Oronite Chemical Company (45)

DISTILLING EQUIPMENT, Industrial

Aluminum Company of America (225–226–227–228)
Barnstead Still and Sterilizer Co. (127)
Blaw-Knox Company (365–366)
Buflovak Equipment Division of Blaw-Knox Co. (303–304–305)
Consolidated Products Co. Inc. (361)
Eimer & Amend (20)
Fansteel Metallurgical Corporation (137)
Fisher Scientific Co. (20)
Glascote Products, Inc. (95)
Haveg Corporation (94)
Illinois Water Treatment Co. (8)
Infilco Inc. (134)
Loeb Equipment Supply Co. (91–92)
National Carbon Co., Inc. (12–13)
Schaar & Co. (31)
Selas Corporation of America (88–89)

DRYING EQUIPMENT

Blaw-Knox Company (365–366)
Buflovak Equipment Division of Blaw-Knox Co. (303–304–305)
By-Products Steel Co., Division of Lukens Steel Company (9–10)
Arthur Colton Company (210)
Combustion Engineering Company, Inc., Raymond Pulverizer Division (69)
Consolidated Products Co. Inc. (361)
The Davison Chemical Corporation (59–60)
J. W. Greer Company (301–302)
Hardinge Company, Inc. (224)
Haveg Corporation (94)

(*Continued on page* 394)

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2 TO 20 TIMES ----- FASTER!

ON TOUGH DISSOLVING & DISPERSING JOBS

With an impeller that elevates and swings in a 180° arc, model B is suited to rapid processing of batches brought to the machine in containers.

COWLES
Ultra-Fast
DISSOLVER
Faster because it develops laminar interface shear

Two to twenty times faster than conventional mixers, the Cowles Ultra-Fast Dissolver has an impeller of advanced design that sets up components of laminar flow, producing interface shear between multiple laminae with a high velocity gradient. The combined area of the many surfaces exposed to the shearing action plus the thinness of each laminae, subjects every particle in the batch to shear and scrubbing forces, greatly accelerating the dissolving and dispersing action.

Practically pure solutions and intimately-mingled colloidal dispersions are produced. There is no wait for undissolved residues or suspended solids to go into solution . . . no slow feeding . . . no clumping or balling of the dispersed medium in process. Splash and dead spots are virtually eliminated.

Safe, Silent, Long-Wearing

A high degree of balance in the rotating parts, coupled with rubber mountings, eliminates noise and destructive vibration. The rugged structure of the machine, the proved quality of the bearings and motor, all insure long life and low maintenance. For volatile and flammable solvents, solutes or sols, an explosion-proof motor, non-sparking tank and impeller—each adequately grounded for extra safety—are available.

Tanks and Removable Tank Models

The Cowles Dissolver is available from stock with tanks of 100 gal., 250 gal., or 500 gal. capacity; also in models for use in tanks or containers brought to the machine. Motor speed, horsepower and design of impeller are all adjusted to the gallonage, viscosity, physical and chemical properties of the materials you wish to process.

SEE OUR EXHIBIT
NATIONAL CHEMICAL EXPOSITION

BOOTHS
217 & 218

Model A has a tank especially designed for the Cowles Ultra-Fast impeller. Available with a heat exchanger in the base, it increases solubility, reduces undissolved residues and is easy to clean.

Tell us what your problem is. Write for a descriptive folder . . . or ask for a technical representative to discuss the matter with you. No charge. No obligation.

YEARS OF COMMERCIAL TEST SHOW COWLES DISSOLVER UP TO 10½ HOURS FASTER ON TYPICAL OPERATIONS

Type Operation	Material	Cowles Dissolver	Standard Mixer
Gum Cutting	Rosin	1½ Hrs.	12 Hrs.
Synthetic resin dissolving	Vinylite	1 Hr.	6 Hrs.
N/C solution	Nitrocellulose	12 Min.	90 Min.
Tinting	Enamel	5 Min.	30 Min.
Pigment dispersion	Heavy Enamel	6 Min.	150 Min.
Coating suspension	H. T. Clay	1 Hr.	9 Hrs.

The Cowles Company
INCORPORATED
CAYUGA, N. Y.

Associate: Alexander Fleck, Ltd., Ottawa, Ont.

EXHIBITORS • Classified by Products • CONTINUED

Loeb Equipment Supply Co. (91–92)
Lukens Steel Company and Divisions (9–10)
Lukenweld, Division of Lukens Steel Company (9–10)
The Miskella *Infra-Red* Company (128)
Raymond Pulverizer Division, Combustion Engineering Company, Inc. (69)

DUST COLLECTING SYSTEMS
American Air Filter Company Inc. (307–308–309)
Consolidated Products Co. Inc. (361)
Micro Metallic Corp. (90)
Claude B. Schneible Co. (346)

DYES
American Cyanamid Company (347)

EJECTORS
Consolidated Products Co. Inc. (361)
F. M. deBeers & Associates (115)
General Ceramics and Steatite Corporation (114)
Haveg Corporation (94)
National Carbon Co., Inc. (12–13)

ELECTRICAL COMPUTERS
Consolidated Engineering Corporation (354)

ELECTRICAL EQUIPMENT AND SUPPLIES, Industrial
Martindale Electric Co. (337)
The Miskella *Infra-Red* Company (128)
W. M. Welch Scientific Co. (129)

ELECTROPLATING EQUIPMENT AND SUPPLIES
Commercial Filters Corporation (101)
F. M. deBeers & Associates (115)
Eimer & Amend (20)
Fisher Scientific Co. (20)
Haveg Corporation (94)
Heil Process Equipment Corp. (319)
Illinois Water Treatment Co. (8)
Macbeth Corporation (109)
Micro Metallic Corp. (90)
Standard Oil Company (Indiana) Chemical Products Department (72–73)
The U. S. Stoneware Co. (40–41–42)

EMULSIFIERS
Alrose Chemical Company (313)
Armour Chemical Division, Armour and Company (47)
Atlas Powder Company (126)
Carbide and Carbon Chemicals Corporation (355–356)
Commercial Solvents Corporation (147)
Consolidated Products Co. Inc. (361)
Emery Industries, Inc. (363–364)
Glyco Products Co., Inc. (68)
Hercules Powder Company (36–37)
Loeb Equipment Supply Co. (91–92)
Oronite Chemical Company (45)
Pfaltz & Bauer, Inc. (362)
L. Sonneborn Sons, Inc. (38)
Victor Chemical Works (53–54–55, 62–63–64)

ENGINEERS
Blaw-Knox Company (365–366)
Buflovak Equipment Division of Blaw-Knox Co. (303–304–305)
By-Products Steel Co., Division of Lukens Steel Company (9–10)
F. M. deBeers & Associates (115)
Lukens Steel Company and Divisions (9–10)
Lukenweld, Division of Lukens Steel Company (9–10)

ESTERS
Alrose Chemical Company (313)
Carbide and Carbon Chemicals Corporation (355–356)
Commercial Solvents Corporation (147)
Emery Industries, Inc. (363–364)
Glyco Products Co., Inc. (68)
The Matheson Co., Inc. (131)
Victor Chemical Works (53–54–55, 62–63–64)

ETHERS
Carbide and Carbon Chemicals Corporation (355–356)
Commercial Solvents Corporation (147)
The Matheson Co., Inc. (131)

EVAPORATORS
Blaw-Knox Company (365–366)
Buflovak Equipment Division of Blaw-Knox Co. (303–304–305)
Consolidated Products Co. Inc. (361)
F. M. deBeers & Associates (115)
Fansteel Metallurgical Corporation (137)
Glascote Products, Inc. (95)
Graham Manufacturing Co. Inc. (56)
Groen Mfg. Co. (33—34–35)
Haveg Corporation (94)
Loeb Equipment Supply Co. (91–92)
Mojonnier Bros. Co. (326–327)
National Carbon Co., Inc. (12–13)

EXHAUSTERS—See Fans

EXPLOSIVES
Atlas Powder Company (126)
Hercules Powder Company (36–37)

EXTRACTION EQUIPMENT
Blaw-Knox Company (365–366)
Buflovak Equipment Division of Blaw-Knox Co. (303–304–305)
Consolidated Products Co. Inc. (361)
General Ceramics and Steatite Corporation (114)
Haveg Corporation (94)
Loeb Equipment Supply Co. (91–92)
The Ludlow-Saylor Wire Company (343)

FANS, BLOWERS AND EXHAUSTERS
American Air Filter Company Inc. (307–308–309)
F. M. deBeers & Associates (115)
General Ceramics and Steatite Corporation (114)
Haveg Corporation (94)
Kewaunee Mfg. Co. (104–105)
Laboratory Furniture Co., Inc. (116)
Martindale Electric Co. (337)
Mine Safety Appliances Company (334)
The U. S. Stoneware Co. (40–41–42)

FERTILIZERS
American Cyanamid Company (347)
The Davison Chemical Corporation (59–60)

FILLING EQUIPMENT—See Packaging Equipment

FILTER MEDIA
The Eimco Corporation (320–321–322)
Eimer & Amend (20)
The Filter Paper Company (121–122)
Fisher Scientific Co. (20)
Hercules Filter Corporation (117)
F. R. Hormann & Co., Inc. (142)
Infilco Inc. (134)
Micro Metallic Corp. (90)
Niagara Filter Corporation (1–2)
Schaar & Co. (31)
Selas Corporation of America (88–89)
Selwyn Engineering Company (1–2)
D. R. Sperry & Co. (57)
The U. S. Stoneware Co. (40–41–42)

FILTERS AND FILTER PRESSES
Commercial Filters Corporation (101)
Consolidated Products Co. Inc. (361)
Corning Glass Works (314)
F. M. deBeers & Associates (115)
Denver Equipment Company (83)
The Eimco Corporation (320–321–322)
Enzinger Union Corp. (48)
Eriez Manufacturing Company (358)
The Filter Paper Company (121–122)
General Ceramics and Steatite Corporation (114)
Haveg Corporation (94)
Hercules Filter Corporation (117)
F. R. Hormann & Co., Inc. (142)
Illinois Water Treatment Co. (8)
Infilco Inc. (134)
Klenzade Products, Inc. (93)
Loeb Equipment Supply Co. (91–92)
Micro Metallic Corp. (90)
Niagara Filter Corporation (1–2)
% Proportioneers, Inc. % (93)
Selwyn Engineering Company (1–2)
Specialty Brass Company (24)
D. R. Sperry & Co. (57)
Titeflex, Inc. (146)
Tri-Clover Machine Co. (106)
The U. S. Stoneware Co. (40–41–42)

FIRE AND FLAMEPROOFING MATERIALS
Carbide and Carbon Chemicals Corporation (355–356)
Glyco Products Co., Inc. (68)
Hercules Powder Company (36–37)
Victor Chemical Works (53–54–55, 62–63–64)

FITTINGS, Valve and Pipe
F. M. deBeers & Associates (115)
The Filter Paper Company (121–122)
General Ceramics and Steatite Corporation (114)
Glascote Products, Inc. (95)
Hasco Valve & Mach Co. (108)
Haveg Corporation (94)
Heil Process Equipment Corp. (319)
Homestead Valve Manufacturing Co. (324)
National Carbon Co., Inc. (12–13)
Specialty Brass Company (24)
Titeflex, Inc. (146)
Tri-Clover Machine Co. (106)
The U. S. Stoneware Co. (40–41–42)
U. S. Steel Corp. (336)

FLOTATION AGENTS
Alrose Chemical Company (313)
American Cyanamid Company (347)
Armour Chemical Division, Armour and Company (47)
Carbide and Carbon Chemicals Corporation (355–356)
Denver Equipment Company (83)
Hercules Powder Company (36–37)
Oronite Chemical Company (45)
L. Sonneborn Sons, Inc. (38)

FLOTATION MACHINES
Denver Equipment Company (83)

(*Continued on page 396*)

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Big things are happening at Sivyer! Rushing to completion is a new building program—so Sivyer can serve you even better.

There's expanded foundry capacity for high alloy casting . . . new induction melting furnace facilities . . . new grades of alloys including Sivyer 20 (same as Durimet 20 and made under license from Duriron Company) . . . new service for electro-polishing of stainless castings . . . *plus* faster deliveries.

Now, more than ever, you should make Sivyer your source for quality corrosion-resistant steel castings.

See us at the
National Chemical Exposition
October 12-16 • Booth 107

SIVYER STEEL CASTING COMPANY
MILWAUKEE CHICAGO

FLUORIDES
American Cyanamid Company (347)
The Davison Chemical Corporation (59–60)
The Matheson Co., Inc. (131)

FOOD PROCESSING EQUIPMENT
Buflovak Equipment Division of Blaw-Knox Co. (303–304–305)
Fansteel Metallurgical Corporation (137)

FORMATES
Carbide and Carbon Chemicals Corporation (355–356)
Commercial Solvents Corporation (147)
Victor Chemical Works (53–54–55, 62–63–64)

FUNGICIDES
American Cyanamid Company (347)
Armour Chemical Division, Armour and Company (47)
Atlas Powder Company (126)
Carbide and Carbon Chemicals Corporation (355–356)
Socony-Vacuum Oil Company, Inc. (49)
Standard Oil Company (Indiana) Chemical Products Department (72–73)
Victor Chemical Works (53–54–55, 62–63–64)

FURNACES, Industrial
K. H. Huppert Company (46)
Selas Corporation of America (88–89)

GAS HANDLING EQUIPMENT
Blaw-Knox Company (365–366)
The Davison Chemical Corporation (59–60)
General Ceramics and Steatite Corporation (114)
Haveg Corporation (94)
The Matheson Co., Inc. (131)

GASES
Carbide and Carbon Chemicals Corporation (355–356)
The Matheson Co., Inc. (131)
The Ohio Chemical & Mfg. Co. (330)

GASKETS
United States Gasket Company (222)

GAUGES
George E. Fredericks Company (206–207)
The Matheson Co., Inc. (131)
W. M. Welch Scientific Co. (129)

GERMICIDES
Alrose Chemical Company (313)
Armour Chemical Division, Armour and Company (47)
Carbide and Carbon Chemicals Corporation (355–356)
Hercules Powder Company (36–37)

GLASS, Optical
Corning Glass Works (314)

GLASS PIPE
Corning Glass Works (314)

GLASSWARE, Industrial
George E. Fredericks Company (206–207)

GLASSWARE, Laboratory
Ace Glass Incorporated (201)
Central Scientific Company (58)
Chicago Apparatus Company (135)
Corning Glass Works (314)
Eimer & Amend (20)
Fisher Scientific Co. (20)
George E. Fredericks Company (206–207)
Kimble Glass, Division of Owens-Illinois Glass Company (70–71)
Laboratory Equipment Corporation (119)
Arthur S. LaPine & Company (21)
H. S. Martin & Company (80)
E. H. Sargent & Company (125)
Schaar & Co. (31)
Scientific Glass Apparatus Co. Inc. (17)
W. M. Welch Scientific Co. (129)

GLYCERINE AND DERIVATIVES
Alrose Chemical Company (313)
Emery Industries, Inc. (363–364)
Glyco Products Co., Inc. (68)
The Matheson Co., Inc. (131)

GLYCOLS—See Alcohols, Polyhydric

GRINDERS—See Crushers

HALIDES
The Matheson Co., Inc. (131)

HALO-AROMATICS
The Matheson Co., Inc. (131)

HEAT TRANSFER AGENTS
Blaw-Knox Company (365–366)
Carbide and Carbon Chemicals Corporation (355–356)
F. M. deBeers & Associates (115)
Socony-Vacuum Oil Company, Inc. (49)

HEATERS AND HEAT EXCHANGERS
Aluminum Company of America (225–226–227–228)
Blaw-Knox Company (365–366)
Buflovak Equipment Division of Blaw-Knox Co. (303–304–305)
Chicago Apparatus Company (135)
Consolidated Products Co. Inc. (361)
F. M. deBeers & Associates (115)
Defiance Machine Works, Inc. (211)
Fansteel Metallurgical Corporation (137)
General Ceramics and Steatite Corporation (114)
Graham Manufacturing Co. Inc. (56)
Hasco Valve & Mach. Co. (108)
Haveg Corporation (94)
Heil Process Equipment Corp. (319)
The Miskella *Infra-Red* Company (128)
Mojonnier Bros. Co. (326–327)
National Carbon Co., Inc. (12–13)
Portable Pump Company (56)
Selas Corporation of America (88–89)
Specialty Brass Company (24)
U. S. Steel Corp. (336)
Walker-Wallace Incorporated (223)

HIGH VACUUM EQUIPMENT
Buflovak Equipment Division of Blaw-Knox Co. (303–304–305)
Central Scientific Company (58)
Consolidated Engineering Corporation (354)
F. M. deBeers & Associates (115)
George E. Fredericks Company (206–207)
Groen Mfg. Co. (33–34–35)
Haveg Corporation (94)
Mojonnier Bros. Co. (326–327)
(*Continued on page* 398)

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3 WAYS TO STOP CORROSION

Line-Tite
Vinyl-Clad
VinyLac

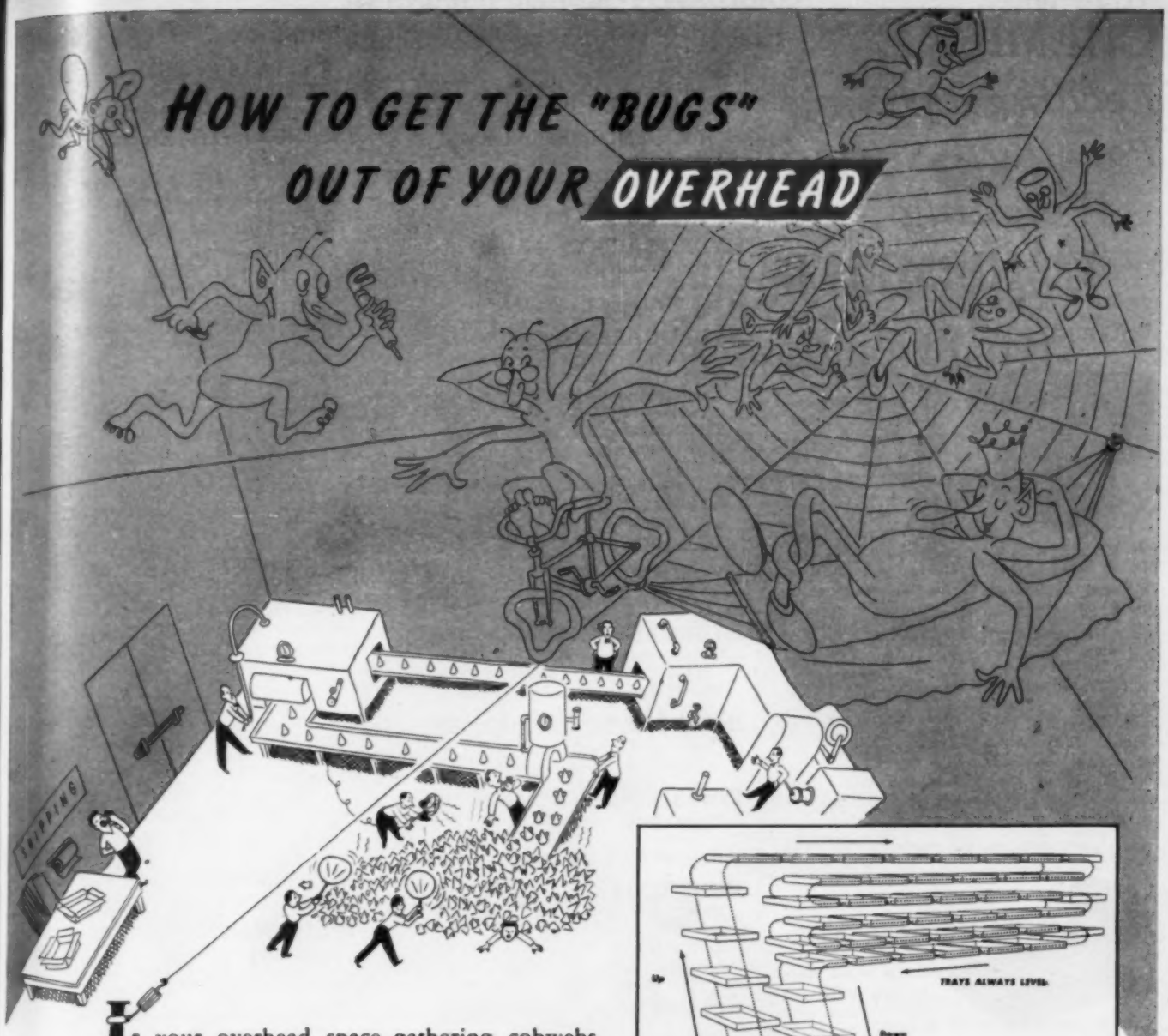
See Us Booth 220

These products are based on copolymer vinyl resins with proven performance over the past 10 years.
Each problem is specifically engineered from our experience in hundreds of varied applications throughout the corrosive field.
We are now solving corrosion problems in the major industries such as chemical, petroleum, food and dairy, paper, hydro electric power, mining, etc.
Let us help you.

• Write for our new catalog

PLASTIC LINING CORPORATION
PROTECTIVE PLASTIC COATINGS
914 South Wabash Avenue Chicago 5, Illinois
World's Pioneer of Vinyl Industrial Protective Coatings

BOOTH 220



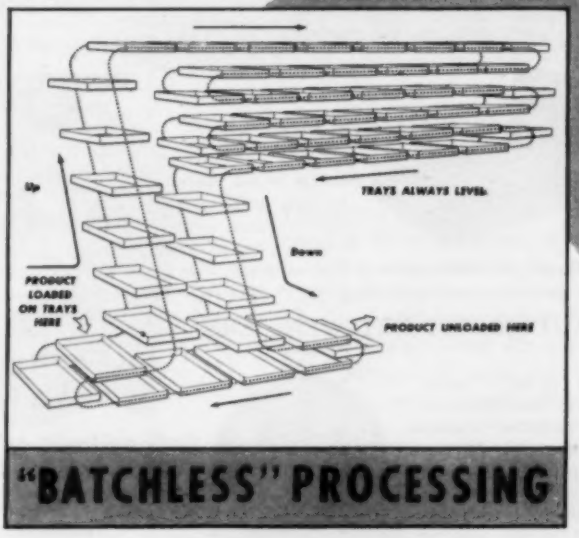
Is your overhead space gathering cobwebs while your production floor is jammed? Does your process require prolonged "waiting time" during which your product is stacked in valuable floor space?

If you are suffering from this production bottleneck, take advantage of wasted overhead space by processing *continuously* with Greer Multi-Tier. You'll be able to free hundreds, even thousands of feet of floor space for other operations and materially reduce your production costs.

One manufacturer who converted from batch methods to *continuous* processing with Greer Multi-Tier was able to triple his production in the same plant. Through the elimination of handling, his savings at the end of the first year amounted to one half the cost of the machine!

For complete details on the Greer Multi-Tier, write today for our new, descriptive folder.

J. W. GREER COMPANY
124 WINDSOR ST., CAMBRIDGE 39, MASS.



"BATCHLESS" PROCESSING

GREER MULTI-TIER

Manufacturers of Continuous Production Machinery

CHEMICAL
Feeding • Mixing
Packing • Sifting
Weighing
EQUIPMENT

BAR-NUN ROTARY SIFTERS

Provide thorough separation, by particle size, of dry materials in flaked, granular, or powdered forms. Large capacity results from use of complete rotary motion "mechanically controlled". Standard models furnished with one, two, or three screens, to deliver two, three, or four sizes of product in grading, scalping, or sifting applications.

DRAVER FEEDERS

For feeding accurately, by volume, predetermined amounts of dry materials in flaked, granular, or powdered forms. Feeding rates closely controlled. Also used for continuous mixing systems. Over 100 standard sizes and models are available.

VIBROX PACKERS

Efficient, smooth-running, vibrating-rocking container packers which usually repay their own costs in a short time by cutting container, handling, and labor costs. Five standard sizes for container capacities from 5 to 750 pounds.

AUTOMATIC NET WEIGHERS

Bar-Nun "Auto-Check" Net Weighers and Edtbauer-Duplex Automatic Net Weighers provide extremely accurate net weights in ranges between ¼ of 1 ounce and 50 pounds. For most dry, free flowing and semi-free flowing materials.

ENGINEERING SERVICE

Gump Engineers will be glad to work with you in selecting the Gump-Built Equipment best suited to your specific processing requirements.

SEE US IN BOOTHS NO. 22 and 23

B. F. Gump Co.

Engineers and Manufacturers Since 1872

422 South Clinton Street • Chicago 7, Ill.

EXHIBITORS • Classified by Products • CONTINUED

Portable Pump Company (56)
E. H. Sargent & Company (125)
W. M. Welch Scientific Co. (129)

HOMOGENIZERS, Industrial
Consolidated Products Co. Inc. (361)
The W. J. Fitzpatrick Co. Inc. (84–85)
Loeb Equipment Supply Co. (91–92)

HYDROCARBON GASES
Carbide and Carbon Chemicals Corporation (355–356)
The Matheson Co., Inc. (131)

HYDROCARBONS
Anderson-Prichard Oil Corporation (331)
Carbide and Carbon Chemicals Corporation (355–356)
The Matheson Co., Inc. (131)
Socony-Vacuum Oil Company, Inc. (49)
L. Sonneborn Sons, Inc. (38)
Standard Oil Company (Indiana) Chemical Products Department (72–73)

HYDROGEN ION APPARATUS—See pH Equipment

HYDROXYLAMINES
Commercial Solvents Corporation (147)
The Matheson Co., Inc. (131)

IMPREGNATING EQUIPMENT
Buflovak Equipment Division of Blaw-Knox Co. (303–304–305)

INDUSTRIAL RESEARCH
Anderson-Prichard Oil Corporation (331)
Battelle Memorial Institute (348)

INHIBITORS
Socony-Vacuum Oil Company, Inc. (49)
L. Sonneborn Sons, Inc. (38)
Victor Chemical Works (53–54–55, 62–63–64)

INSECTICIDES AND BASES
Aluminum Company of America (225–226–227–228)
Atlas Powder Company (126)
Carbide and Carbon Chemicals Corporation (355–356)
Commercial Solvents Corporation (147)
The Davison Chemical Corporation (59–60)
Hercules Powder Company (36–37)
Socony-Vacuum Oil Company, Inc. (49)
L. Sonneborn Sons, Inc. (38)
Standard Oil Company (Indiana) Chemical Products Department (72–73)
Victor Chemical Works (53–54–55, 62–63–64)

INSTRUMENTS, Electrical — Industrial
Consolidated Engineering Corporation (354)
Eimer & Amend (20)
Fisher Scientific Co. (20)
Hart-Moisture-Meters (349)
Industrial Instruments Inc. (315)
Leeds & Northrup Company (357)
Macbeth Corporation (109)
Martindale Electric Co. (337)
Mine Safety Appliances Company (334)
National Technical Laboratories (25–26)
W. M. Welch Scientific Co. (129)

INSTRUMENTS, Electrical—Laboratory
Chicago Apparatus Company (135)
Consolidated Engineering Corporation (354)
Eimer & Amend (20)
Fisher Scientific Co. (20)
Hart-Moisture-Meters (349)
Industrial Instruments Inc. (315)
W. H. Kessel & Co. (120)
Arthur S. LaPine & Company (21)
Leeds & Northrup Company (357)
Macbeth Corporation (109)
Martindale Electric Co. (337)
Mine Safety Appliances Company (334)
National Technical Laboratories (25–26)
Pfaltz & Bauer, Inc. (362)
Schaar & Co. (31)
Scientific Glass Apparatus Co. Inc. (17)
W. M. Welch Scientific Co. (129)
Wilkens-Anderson Company (111)

INSTRUMENTS, Optical
American Optical Company (208–209)
Buehler Ltd. (328–329)
Chicago Apparatus Company (135)
Eimer & Amend (20)
Fisher Scientific Co. (20)
W. H. Kessel & Co. (120)
Mine Safety Appliances Company (334)
National Technical Laboratories (25–26)
Pfaltz & Bauer, Inc. (362)
E. H. Sargent & Company (125)
W. M. Welch Scientific Co. (129)

INSTRUMENTS, Repairing
E. H. Sargent & Company (125)

INSTRUMENTS, Scientific—Laboratory
Barnstead Still and Sterilizer Co. (127)
Buehler Ltd. (328–329)
Central Scientific Company (58)
Chicago Apparatus Company (135)
Consolidated Engineering Corporation (354)
Eimer & Amend (20)
Fisher Scientific Co. (20)
George E. Fredericks Company (206–207)
Hart-Moisture-Meters (349)
Industrial Instruments Inc. (315)
W. H. Kessel & Co. (120)
Kimble Glass, Division of Owens-Illinois Glass Company (70–71)
Laboratory Equipment Corporation (119)
Arthur S. LaPine & Company (21)
Leeds & Northrup Company (357)
Macbeth Corporation (109)
H. S. Martin & Company (80)
Mine Safety Appliances Company (334)
National Technical Laboratories (25–26)
Owens-Illinois Glass Company, Kimble Glass Division (70–71)
Pfaltz & Bauer, Inc. (362)
E. H. Sargent & Company (125)
Schaar & Co. (31)
Scientific Glass Apparatus Co. Inc. (17)
W. M. Welch Scientific Co. (129)
Wilkens-Anderson Company (111)

(Continued on page 400)

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SIMPSON *Intensive* MIXER

SOLVES A DIFFICULT BLENDING PROBLEM

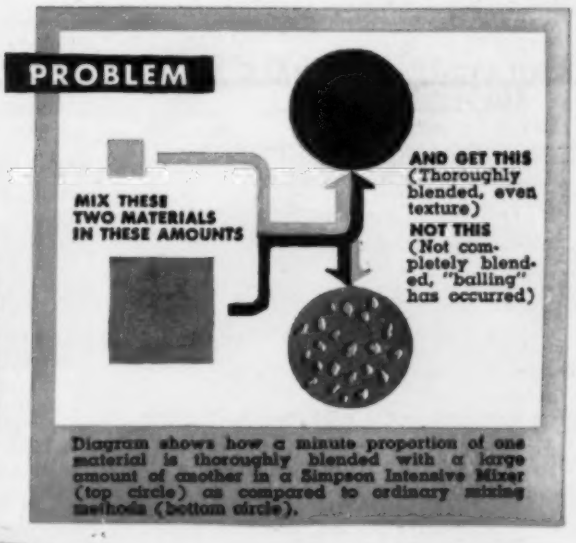
PROBLEM
MIX THESE TWO MATERIALS IN THESE AMOUNTS
AND GET THIS (Thoroughly blended, even texture)
NOT THIS (Not completely blended, "balling" has occurred)

Diagram shows how a minute proportion of one material is thoroughly blended with a large amount of another in a Simpson Intensive Mixer (top circle) as compared to ordinary mixing methods (bottom circle).

A large midwest processor had difficulty in uniformly mixing and blending a minute quantity of an active ingredient into an inert carrier substance. In the first mixing operation, done by a ribbon-type mixer, the active material was not thoroughly dispersed in the carrier, and a second, time-consuming grinder operation was necessary to complete the dispersion. A Simpson Intensive Mixer was installed and, in a single operation, thorough, more rapid mixing was accomplished.

• Simpson Intensive Mixers are available in 10 sizes, from ⅛ to 50 cu. ft. capacity for mulling every type of dry, semi-dry or plastic material. Also available with oil, steam or water jackets for vacuum mixing, and may be had in corrosion-resistant materials. Many new applications are being found where the "mulling action" of a Simpson Intensive Mixer does a better job in less time. Let a National Engineer analyze your mixing requirements.

THE MULLING PRINCIPLE OF CONTROLLED MIXING

The unique "mulling action" of a Simpson Intensive Mixer, shown above, is comparable to the rubbing, kneading and smearing action of a mortar and pestle. This kind of mixing action eliminates any "balling" of materials and quickly effects a thorough dispersion of the elements in the mix. The result is a finished product of uniform quality. Because of the positive control obtained throughout this mixing process, it is known as "Controlled Mixing."

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NATIONAL *Engineering Company*

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EXHIBITORS • Classified by Products • CONTINUED

INSTRUMENTS, Testing — Industrial
Barnstead Still and Sterilizer Co. (127)
Buehler Ltd. (328–329)
Consolidated Engineering Corporation (354)
Hart-Moisture-Meters (349)
Industrial Instruments Inc. (315)
W. H. Kessel & Co. (120)
Laboratory Equipment Corporation (119)
Leeds & Northrup Company (357)
Macbeth Corporation (109)
Martindale Electric Co. (337)
Mine Safety Appliances Company (334)
National Technical Laboratories (25–26)
Pfaltz & Bauer, Inc. (362)
Milton Roy Company (5–6)
Wallace & Tiernan Products, Inc. (342)

INSULATING MATERIALS AND SUPPLIES
Haveg Corporation (94)

ION EXCHANGE EQUIPMENT
American Cyanamid Company (347)
Barnstead Still and Sterilizer Co. (127)
Consolidated Products Co. Inc. (361)
F. M. deBeers & Associates (115)
The Filter Paper Company (121–122)
Illinois Water Treatment Co. (8)
Infilco Inc. (134)
E. H. Sargent & Company (125)
Schaar & Co. (31)

ION EXCHANGE RESINS
American Cyanamid Company (347)
Barnstead Still and Sterilizer Co. (127)
Illinois Water Treatment Co. (8)
Infilco Inc. (134)
National Aluminate Corporation (335)

JOINTS, Flexible
Barco Manufacturing Company (318)
Corning Glass Works (314)
F. M. deBeers & Associates (115)
Tri-Clover Machine Co. (106)
The U. S. Stoneware Co. (40–41–42)

KETONES
American Cyanamid Company (347)
Armour Chemical Division, Armour and Company (47)
Carbide and Carbon Chemicals Corporation (355–356)
Commercial Solvents Corporation (147)
The Matheson Co., Inc. (131)

KETTLES
Aluminum Company of America (225–226–227–228)
Blaw-Knox Company (365–366)
Buflovak Equipment Division of Blaw-Knox Co. (303–304–305)
F. M. deBeers & Associates (115)
The Filter Paper Company (121–122)
Glascote Products, Inc. (95)
Groen Mfg. Co. (33–34–35)
Haveg Corporation (94)
Loeb Equipment Supply Co. (91–92)
The U. S. Stoneware Co. (40–41–42)

KILNS
Consolidated Products Co. Inc. (361)
Hardinge Company, Inc. (224)
Loeb Equipment Supply Co. (91–92)
The Miskella *Infra-Red* Company (128)
Selas Corporation of America (88–89)

LABORATORIES, Testing
Anderson-Prichard Oil Corporation (331)
Buflovak Equipment Division of Blaw-Knox Co. (303–304–305)
Denver Equipment Company (83)
Eimer & Amend (20)
Fisher Scientific Co. (20)
Hart-Moisture-Meters (349)
W. H. Kessel & Co. (120)
Laboratory Equipment Corporation (119)
Mojonnier Bros. Co. (326–327)

LABORATORY APPARATUS AND SUPPLIES
Buehler Ltd. (328–329)
Central Scientific Company (58)
Chicago Apparatus Company (135)
Corning Glass Works (314)
The J. H. Day Company (229)
F. M. deBeers & Associates (115)
Denver Equipment Company (83)
Eimer & Amend (20)
Fisher Scientific Co. (20)
George E. Fredericks Company (206–207)
Groen Mfg. Co. (33–34–35)
Hercules Filter Corporation (117)
Illinois Water Treatment Co. (8)
W. H. Kessel & Co. (120)
Arthur S. LaPine & Company (21)
H. S. Martin & Company (80)
Micro Metallic Corp. (90)
Mojonnier Bros. Co. (326–327)
National Technical Laboratories (25–26)
Pfaltz & Bauer, Inc. (362)
The Pioneer Rubber Company (341)
E. H. Sargent & Company (125)
Schaar & Co. (31)
Scientific Glass Apparatus Co. Inc. (17)
Selas Corporation of America (88–89)
The U. S. Stoneware Co. (40–41–42)
W. M. Welch Scientific Co. (129)
Wilkens-Anderson Company (111)

LABORATORY FURNITURE
Alberene Stone Corp. of Va. (123–124)
Chicago Apparatus Company (135)
Eimer & Amend (20)
Fisher Scientific Co. (20)
Hamilton Manufacturing Company (29)
Kewaunee Mfg. Co. (104–105)
Laboratory Furniture Co., Inc. (116)
Arthur S. LaPine & Company (21)
W. M. Welch Scientific Co. (129)

LACQUERS AND BASES
Atlas Powder Company (126)
F. M. deBeers & Associates (115)
Hercules Powder Company (36–37)
Plastic Lining Corporation (220)
The U. S. Stoneware Co. (40–41–42)

LEAK DETECTORS
Consolidated Engineering Corporation (354)
Mine Safety Appliances Company (334)

LININGS, Corrosion Resistant
F. M. deBeers & Associates (115)
Glascote Products, Inc. (95)
Hardinge Company, Inc. (224)
Haveg Corporation (94)
Heil Process Equipment Corp. (319)
National Carbon Co., Inc. (12–13)
Plastic Lining Corporation (220)

(*Continued on page 402*)

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can be specially designed to reduce the possibility of

PERCHLORIC ACID EXPLOSIONS

Alberene Stone Corporation Engineers have made studies of explosions which have occurred in fume hoods where perchloric acid has been used. As a result of these studies we are now in a position to offer certain constructive suggestions with regard to the alteration of existing hoods or the design of new hoods which we believe will have the effect of greatly reducing the possibility of such explosions. We are also in a position to promptly contract for the execution of this work.

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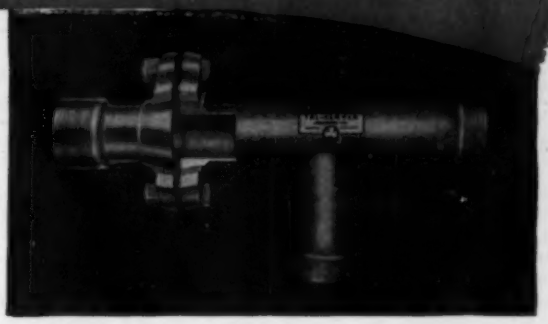
ALBERENE STONE
LABORATORY EQUIPMENT

BOOTHS 123-124

NOW - ONE SOURCE OF SUPPLY...



1 FLANGED TYPE *Conical End* FITTINGS

... fabricated from stainless steel type 316 for use with commercial tolerance light gauge tubing having outside diameters from 1" thru 10". Easily assembled with lightweight, high strength couplings (as shown), which provide an extremely compact, flush, leak-tight union for working pressures up to 250 psi. Complete line of ells, tees, crosses, adapters, etc., polished or pickled finish.

2 "*Zephyrweld*" WELDING FITTINGS

...in sizes from 1" thru 24" O.D., fabricated in gauges from 16 to 10, for use with stainless steel light gauge O. D. tubing, under broad corrosive conditions requiring semi-permanent or permanent welded line installation. Complete line of ells, tees, crosses, adapters, etc., in stainless steel types 304, 316, 347 ... available polished or pickled finish.

FOR ALL 5 STAINLESS STEEL CORROSION-RESISTANT FITTING TYPES!

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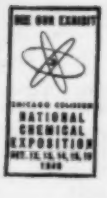

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Standard Oil Company (Indiana) Chemical Products Department (72–73)
Titeflex, Inc. (146)
U. S. Steel Corp. (336)
Victor Chemical Works (53–54–55, 62–63–64)

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Glyco Products Co., Inc. (68)
L. Sonneborn Sons, Inc. (38)
Standard Oil Company (Indiana) Chemical Products Department (72–73)

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By-Products Steel Co., Division of Lukens Steel Company (9–10)
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Fansteel Metallurgical Corporation (137)
B. F. Gump Co. (22–23)
Lukens Steel Company and Divisions (9–10)
Lukenweld, Division of Lukens Steel Company (9–10)

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Aluminum Company of America (225–226–227–228)
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Consolidated Engineering Corporation (354)
Dings Magnetic Separator Co. (118)

MANNITOL AND DERIVATIVES
Atlas Powder Company (126)
The Matheson Co., Inc. (131)

MANOMETERS, Industrial
Infilco Inc. (134)
Arthur S. LaPine & Company (21)

MASS SPECTROMETERS
Consolidated Engineering Corporation (354)

MATERIALS HANDLING EQUIPMENT
American Machine & Foundry Company (359–360)
Blaw-Knox Company (365–366)
The Filter Paper Company (121–122)
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B. F. Gump Co. (22–23)
National Engineering Company (132–133)
The Pioneer Rubber Company (341)
Milton Roy Company (5–6)
The U. S. Stoneware Co. (40–41–42)

METALLURGICAL RESEARCH
Battelle Memorial Institute (348)
Denver Equipment Company (83)
W. H. Kessel & Co. (120)
Laboratory Equipment Corporation (119)

METALS AND ALLOYS
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Lukens Steel Company and Divisions (9–10)
Lukenweld, Division of Lukens Steel Company (9–10)
Tri-Clover Machine Co. (106)
U. S. Steel Corp. (336)

METERS, Indicating and Recording—Industrial
Leeds & Northrup Company (357)
Mine Safety Appliances Company (334)
National Technical Laboratories (25–26)

MILLS—See Crushers

MIXERS, Industrial
American Machine & Foundry Company (359–360)
Blaw-Knox Company (365–366)
Buflovak Equipment Division of Blaw-Knox Co. (303–304–305)
Consolidated Products Co. Inc. (361)
The Cowles Co. (217–218)
The J. H. Day Company (229)
Denver Equipment Company (83)
The Filter Paper Company (121–122)
Groen Mfg. Co. (33–34–35)
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Loeb Equipment Supply Co. (91–92)
National Engineering Company (132–133)
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The Matheson Co., Inc. (131)

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Commercial Solvents Corporation (147)
The Matheson Co., Inc. (131)

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Commercial Solvents Corporation (147)
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L. Sonneborn Sons, Inc. (38)
Standard Oil Company (Indiana) Chemical Products Department (72–73)
Victor Chemical Works (53–54–55, 62–63–64)

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(*Continued on page 404*)

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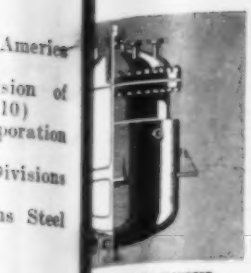
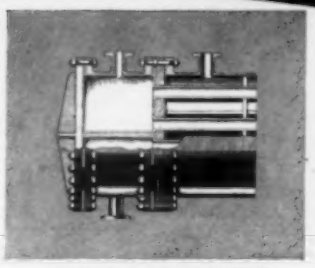


S LEAD LINED JACKETED
H HOMOGENEOUS LEAD
ED AGITATOR



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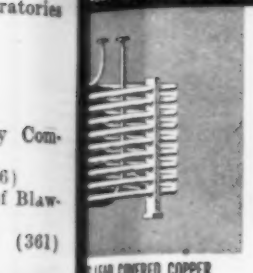

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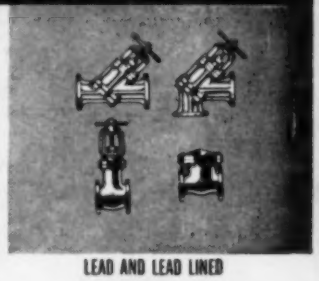

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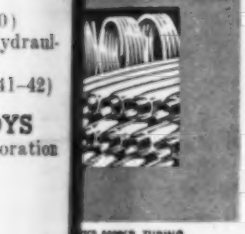
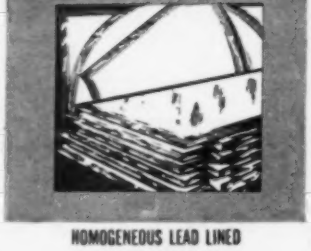


ED COPPER TUBING
NG AND COOLING
COILS



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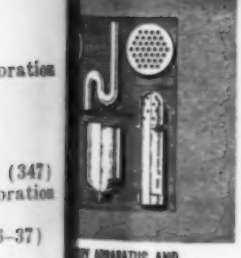

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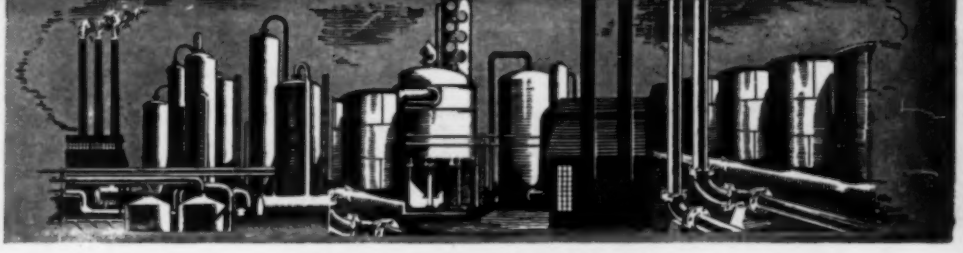

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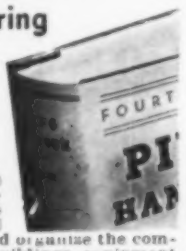

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Operating Engineer, Assoc. Ed., Power
426 pp., over 500 illus., $6.00

Reflecting practical on-the-job experience this book guides you in setting up, operating, and maintaining trouble-free control systems. It explains the basic principles of control and provides complete information for solving metering and control problems. The most modern instruments for measuring and controlling liquid levels, pressure, temperature, speed and humidity are described with simplified diagrams making clear their construction and operation.

Water Treatment and Purification
By WILLIAM J. RYAN
Rev. 2nd ed., 270 pp., 5½ x 8, 66 illus., $3.25

This revised handbook is your practical guide to processes and apparatus for treating and purifying water. In simple terms and with many diagrams, photographs and drawings, it describes the construction and operation of the different types of filtering, softening and treating apparatus, and explains what chemical reactions take place in each treatment. Here is helpful information on sedimentation tanks, coagulation basins, chemical feeding devices, filtration plants, softening apparatus and ion exchange apparatus.

Piping Handbook
By SABIN CROCKER
Mech. Eng., Ebasco Services, Inc.
4th ed., 1176 pp., 4½ x 7½, 763 illus., $7.50

Here's your answer to effective piping design and application—brings you the data and methods you need for solving every piping problem. This handbook covers such major fields of piping as: power plant piping, gas piping, oil piping, water distribution, fire protection piping, etc.

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☐ Ryan—Water Treatment and Purification ($3.25)
☐ Crocker—Piping Handbook ($7.50)

Name .....
Address .....
City and State .....
Company .....
Position CE-9-48

EXHIBITORS • Classified by Products • CONTINUED

Carbide and Carbon Chemicals Corporation (355–356)
Emery Industries, Inc. (363–364)
Socony-Vacuum Oil Company, Inc. (49)
L. Sonneborn Sons, Inc. (38)
Standard Oil Company (Indiana) Chemical Products Department (72–73)

OLEFIN OXIDES
Carbide and Carbon Chemicals Corporation (355–356)
The Matheson Co., Inc. (131)

OVENS
American Machine & Foundry Company (359–360)
Chicago Apparatus Company (135)
Eimer & Amend (20)
Fisher Scientific Co. (20)
K. H. Huppert Company (46)

OXALIC ACID AND OXALATES
The Matheson Co., Inc. (131)
Victor Chemical Works (53–54–55, 62–63–64)

PACKAGING EQUIPMENT AND SUPPLIES
American Machine & Foundry Company (359–360)
Bagpak Division, International Paper Company (143–144)
Bemis Bro. Bag Co. (74–75)
Arthur Colton Company (210)
Consolidated Products Co. Inc. (361)
The Container Company, Division of Continental Can Co., Inc. (43–44)
Continental Can Co., Inc., The Container Company Division (43–44)
The Davison Chemical Corporation (59–60)
Defiance Machine Works, Inc. (211)
Emery-Carpenter Container Company (136)
The Filter Paper Company (121–122)
B. F. Gump Co. (22–23)
Hercules Filter Corporation (117)
F. R. Hormann & Co., Inc. (142)
International Paper Company, Bagpak Division (143–144)
Loeb Equipment Supply Co. (91–92)
Moionnier Bros. Co. (326–327)
National Box & Lumber Company (306)
St. Regis Paper Company (14–15–16)
The U. S. Stoneware Co. (40–41–42)

PAINTS
Atlas Powder Company (126)
F. M. deBeers & Associates (115)
Hercules Powder Company (36–37)
Plastic Lining Corporation (220)
The U. S. Stoneware Co. (40–41–42)

PAPER AND PAPER PRODUCTS
American Cyanamid Company (347)
Bagpak Division, International Paper Company (143–144)
Bemis Bro. Bag Co. (74–75)
The Container Company, Division of Continental Can Co., Inc. (43–44)
Continental Can Co., Inc., The Container Company Division (43–44)
Emery-Carpenter Container Company (136)
The Filter Paper Company (121–122)
Hercules Powder Company (36–37)
International Paper Company, Bagpak Division (143–144)
Reichhold Chemicals, Inc. (76–77)
St. Regis Paper Company (14–15–16)
Union Bag & Paper Corporation (112–113)

PAPER AND PULP MACHINERY
Blaw-Knox Company (365–366)
By-Products Steel Co., Division of Lukens Steel Company (9–10)
Consolidated Products Co. Inc. (361)
F. M. deBeers & Associates (115)
Loeb Equipment Supply Co. (91–92)
Lukens Steel Company and Divisions (9–10)
Lukenweld, Division of Lukens Steel Company (9–10)
Productive Equipment Corporation (344)

PETROLEUM PRODUCTS
American Cyanamid Company (347)
Anderson-Prichard Oil Corporation (331)
Oronite Chemical Company (45)
Socony-Vacuum Oil Company, Inc. (49)
L. Sonneborn Sons, Inc. (38)
Standard Oil Company (Indiana) Chemical Products Department (72–73)

pH EQUIPMENT
Central Scientific Company (58)
Chicago Apparatus Company (135)
Arthur Colton Company (210)
Denver Equipment Company (83)
Eimer & Amend (20)
Fisher Scientific Co. (20)
George E. Fredericks Company (206–207)
Illinois Water Treatment Co. (8)
Infilco Inc. (134)
W. H. Kessel & Co. (120)
Arthur S. LaPine & Company (21)
Leeds & Northrup Company (357)
Macbeth Corporation (109)
National Technical Laboratories (25–26)
Pfaltz & Bauer, Inc. (362)
Milton Roy Company (5–6)
E. H. Sargent & Company (125)
Schaar & Co. (31)
W. M. Welch Scientific Co. (129)
Wilkens-Anderson Company (111)

PHARMACEUTICALS—See Chemicals, Pharmaceutical

PHENOLS
The Matheson Co., Inc. (131)
Reichhold Chemicals, Inc. (76–77)

PHOSPHORUS AND DERIVATIVES
Victor Chemical Works (53–54–55, 62–63–64)

PHTHALATES
American Cyanamid Company (347)
Carbide and Carbon Chemicals Corporation (355–356)
Commercial Solvents Corporation (147)
Hercules Powder Company (36–37)
The Matheson Co., Inc. (131)

PIGMENTS
Aluminum Company of America (225–226–227–228)
American Cyanamid Company (347)
Reichhold Chemicals, Inc. (76–77)

(*Continued on page 405*)

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EXHIBITORS Classified by Products CONTINUED

PILOT PLANT EQUIPMENT
Blaw-Knox Company (365–366)
Buflovak Equipment Division of Blaw-Knox Co. (303–304–305)
By-Products Steel Co., Division of Lukens Steel Company (9–10)
Consolidated Products Co. Inc. (361)
F. M. deBeers & Associates (115)
Denver Equipment Company (83)
The Eimco Corporation (320–321–322)
Fansteel Metallurgical Corporation (137)
The W. J. Fitzpatrick Co. Inc. (84–85)
General Ceramics and Steatite Corporation (114)
Glascote Products, Inc. (95)
Hardinge Company, Inc. (224)
Haveg Corporation (94)
Hercules Filter Corporation (117)
Klenzade Products, Inc. (93)
The LaBour Company, Inc. (145)
Lukens Steel Company and Divisions (9–10)
Lukenweld, Division of Lukens Steel Company (9–10)
Micro Metallic Corp. (90)
Niagara Filter Corporation (1–2)
Portable Pump Company (56)
%Proportioneers, Inc. % (93)
Milton Roy Company (5–6)
Selwyn Engineering Company (1–2)
Tri-Clover Machine Co. (106)

PIPE—See Fittings

PLANT LOCATIONS
Los Angeles Department of Water & Power (325)

PLASTICIZERS
Alrose Chemical Company (313)
American Cyanamid Company (347)
Armour Chemical Division, Armour and Company (47)
Atlas Powder Company (126)
Carbide and Carbon Chemicals Corporation (355–356)
Commercial Solvents Corporation (147)
Emery Industries, Inc. (363–364)
Glyco Products Co., Inc. (68)
Socony-Vacuum Oil Company, Inc. (49)
L. Sonneborn Sons, Inc. (38)
Standard Oil Company (Indiana) Chemical Products Department (72–73)
Victor Chemical Works (53–54–55, 62–63–64)

PLASTICS
American Cyanamid Company (347)
F. M. deBeers & Associates (115)
Defiance Machine Works, Inc. (211)
Haveg Corporation (94)
Hercules Powder Company (36–37)
Reichhold Chemicals, Inc. (76–77)
The U. S. Stoneware Co. (40–41–42)

PLASTICS, Chemicals and Resins
American Cyanamid Company (347)
Carbide and Carbon Chemicals Corporation (355–356)
F. M. deBeers & Associates (115)
Glyco Products Co., Inc. (68)
Haveg Corporation (94)
Hercules Powder Company (36–37)
Reichhold Chemicals, Inc. (76–77)
The U. S. Stoneware Co. (40–41–42)
Victor Chemical Works (53–54–55, 62–63–64)

(*Continued on page* 406)

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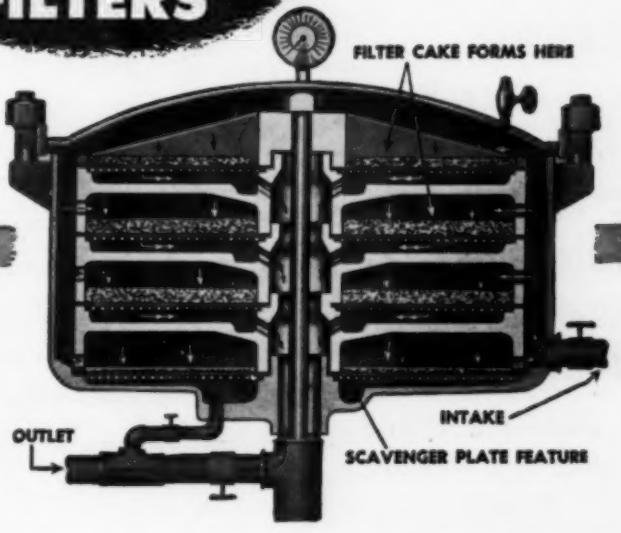
Last Drop filtration of chemicals with

SPARKLER *Horizontal Plate* **FILTERS**



. . . . . any liquid from light alcohols to heavy varnishes

Complete recovery of product is obtained by "wash through" or "blow down" of cake without removal from filter. The Sparkler scavenger plate acts as an auxiliary filter, with independent control valve filtering each batch down to the "last drop," leaving no hold-over. Uniform density and firmness of the Sparkler cake on horizontal plates permit this easy method of complete recovery of product.

The horizontal plate principle of filtering chemicals provides complete flexibility and uniform dependable results. When diatomaceous filter aid is used it forms a pure silica sieve of uniform microsize mesh. Other filter media form a similar firm filter cake on the Sparkler horizontal plates. Flow is always *with* gravity. The horizontal position of the built-up cake prevents slipping or cracking either with continuous or intermittent flow.

Available in two plate depths, Sparkler construction provides deep plates for liquids carrying a large proportion of solids. Sparkler shallow plates for use on liquids carrying only a small proportion of solids provide a larger filtering area within the same size tank.

All Sparkler filters, even the large sizes, can be furnished with a portable base. Standard models available in capacities of 50 G.P.H. to 5000 G.P.H.

Sparkler Filtration is Engineered Filtration—we invite correspondence on your problems. You will receive the advice of filtration engineers with a quarter of a century of experience in a specific field.

SPARKLER MANUFACTURING COMPANY
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BOOTH 115

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PROCESS MACHINERY and EQUIPMENT

★ **EVAPORATORS**
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★ **SPIRAL HEAT EXCH.**
★ **EXPANSION JOINTS**
★ **THERMO-COMPRESSORS**
★ **STEAM-JET UNITS**
★ **CHEM. CERAMIC WARE**
Chem. Stoneware—Porcelain
Impervious Graphite
★ **PLASTIC COVERINGS**
Stoner-Mudge Products
Syn. Resin Lacquers
Linings, Coatings
★ **VAC. COOLING PLANTS**
★ **WASTE HEAT RECOV. SYS.**

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Chemical Engineers
20 NORTH WACKER DRIVE
CHICAGO 6
Tel. RA-6-2326

EXHIBITORS
Classified by Products
CONTINUED

PLASTICS PROCESSING EQUIPMENT
American Machine & Foundry Company (359–360)
Blaw-Knox Company (365–366)
Arthur Colton Company (210)
Consolidated Products Co. Inc. (361)
J. W. Greer Company (301–302)
Haveg Corporation (94)
National Engineering Company (132—133)

PLASTICS, Tubing and Shapes
Haveg Corporation (94)
The U. S. Stoneware Co. (40–41–42)

POLISHING AGENTS
Victor Chemical Works (53–54–55, 62–63–64)

POLYBUTENES
Oronite Chemical Company (45)
Standard Oil Company (Indiana) Chemical Products Department (72–73)

PORCELAIN, Industrial — See Ceramic and Porcelain Equipment

PREHEATERS—See Heaters

PRESSES, Industrial
Consolidated Products Co. Inc. (361)
The Filter Paper Company (121–122)
Hercules Filter Corporation (117)

PROPORTIONING EQUIPMENT
B. F. Gump Co. (22–23)
Klenzade Products, Inc. (93)
% Proportioneers, Inc. % (93)
Milton Roy Company (5–6)
Wallace & Tiernan Products, Inc. (342)

PUBLICATIONS
American Chemical Society (39A)
Analytical Chemistry (39A)
Chemical Engineering (96)
Chemical and Engineering News (39A)
Chemical Industries Magazine (66–67)
Food Industries (96)
Industrial and Engineering Chemistry (39A)
Maclean-Hunter Publishing Corp. (66–67)
McGraw-Hill Publishing Co., Inc. (96)
Reinhold Publishing Corporation (18–19)

PULVERIZERS—See Crushers

PUMPS, Industrial
Consolidated Products Co. Inc. (361)
F. M. deBeers & Associates (115)
Denver Equipment Company (83)
The Filter Paper Company (121–122)
General Ceramics and Steatite Corporation (114)
Haveg Corporation (94)
Klenzade Products, Inc. (93)
The LaBour Company, Inc. (145)
Loeb Equipment Supply Co. (91–92)
National Carbon Co., Inc. (12–13)
Portable Pump Company (56)
% Proportioneers, Inc. % (93)

(*Continued on page 408*)

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BOOTH 115

Midwest representatives of the following designers and builders of modern, efficient

PROCESS MACHINERY and EQUIPMENT

★ **AMERICAN HEAT RECLAIMING CORP.**
★ **CROLL-REYNOLDS CO.**
★ **CROLL-REYNOLDS ENGINEERING CO.**
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★ **GOSLIN-BIRMINGHAM MANUFACTURING CO.**
★ **STONER-MUDGE PRODUCTS**

★ ★ ★

Executives and experienced engineer-experts in each unit operation will be on hand for your service. Meet them. Discuss your problems. Save time and much letter writing in a full exchange of ideas.

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what's back of a flawless rayon?

Smooth, even texture, pliant strength, moth-resistance, uniform dye-ability . . . these are qualities demanded of a flawless rayon fabric. Yet, these advantages could not be engineered without proper filtration. That's why leading rayon manufacturers just naturally rely on the Sperry Plate Filter Press.

The Plate Filter Press is the most widely used filter today because it handles practically any filterable mixture—including viscous substances, filters with precise temperature control, it's low in first cost and low in labor and maintenance costs. These are only a few of the many advantages offered by the Plate Filter Press.

Your product, whatever it is, can enjoy more efficient and economical filtration. If you have a problem, Sperry's experience and facilities are at your disposal.

D. R. SPERRY & COMPANY *BATAVIA, ILLINOIS*

Filtration Engineers for over 50 years

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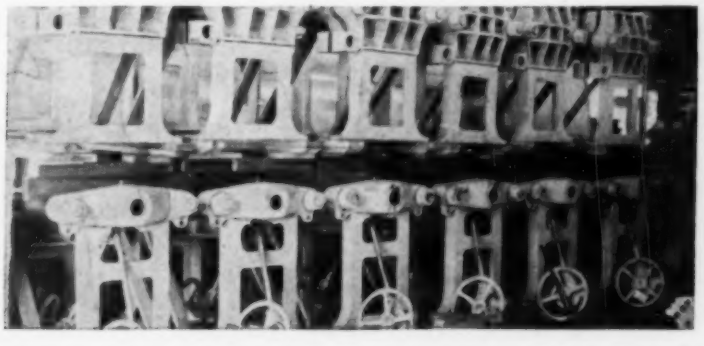
H. E. Jacoby, M. E. • 205 E. 42nd St., New York 17, N.Y. • phone: MUrray Hill 4-3581

Western Sales Representative

B. M. Pilhashy • 833 Merchants Exchange Bldg., San Francisco 4, Cal. • phone: Do 2-0375

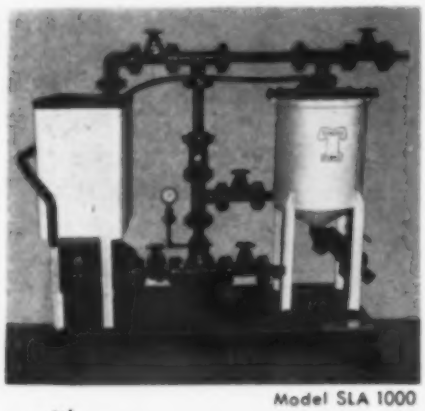


SPERRY FILTER PRESSES

Introducing

Titeflex

SLA Series FILTERS



Model SLA 1000

with

SARAN — Lined Pipe and Fittings

RUBBER — Lined Filter and Precoat Tank

The TITEFLEX Series SLA filters combine the design features of our regular line of filters with the special properties of Saran-lined pipe and fittings and rubber-lined filter and precoat tank.

The Saran and rubber-lined parts have excellent corrosion resistance to a wide variety of organic and inorganic chemicals. In addition, they have superior heat insulating properties and exhibit very good erosion and abrasion resistance.

The TITEFLEX Series SLA filters can be used between 0 and 180°F. It can be cleaned in a few minutes by backwashing and is almost completely automatic. Write for details today.

Titeflex All-Metal Flexible Tubing Available in 5 Metals

TITEFLEX tubing is made from brass, bronze, monel, inconel, and stainless steel—permitting you to select the best material for your particular requirements. Write for Catalog No. 113 containing complete information.

You are cordially invited to visit

Titeflex Booth No. 146

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Titeflex, Inc.

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Exclusive Manufacturers of Titeflex high quality products for more than 30 years

EXHIBITORS • Classified by Products • CONTINUED

Robbins & Myers, Inc. (332–333)
Rockwell Manufacturing Co., Hydraulics Division (97)
Roy E. Roth Company (213)
Milton Roy Company (5–6)
Specialty Brass Company (24)
Tri-Clover Machine Co. (106)
U. S. Steel Corp. (336)
The U. S. Stoneware Co. (40–41–42)
W. M. Welch Scientific Co. (129)

PYROMETERS, Industrial

Eimer & Amend (20)
Fisher Scientific Co. (20)
K. H. Huppert Company (46)
Leeds & Northrup Company (357)

REAGENT CHEMICALS

Central Scientific Company (58)
Denver Equipment Company (83)
Eimer & Amend (20)
Fisher Scientific Co. (20)
Arthur S. LaPine & Company (21)
The Matheson Co., Inc. (131)
Pfaltz & Bauer, Inc. (362)
E. H. Sargent & Company (125)
Schaar & Co. (31)
Scientific Glass Apparatus Co. Inc. (17)
W. M. Welch Scientific Co. (129)

RECORDING INSTRUMENTS — See Meters

REFRACTORIES

Laboratory Equipment Corporation (119)
National Carbon Co., Inc. (12–13)
The U. S. Stoneware Co. (40–41–42)

REFRIGERATING EQUIPMENT

Consolidated Products Co. Inc. (361)
F. M. deBeers & Associates (115)
Graham Manufacturing Co. Inc. (56)

REGULATORS, Pressure

The Ohio Chemical & Mfg. Co. (330)

REGULATORS, Temperature

Scientific Glass Apparatus Co. Inc. (17)

RESEARCH LABORATORIES

Anderson-Prichard Oil Corporation (331)
Battelle Memorial Institute (348)
Buflovak Equipment Division of Blaw-Knox Co. (303–304–305)
Defiance Machine Works, Inc. (211)
W. H. Kessel & Co. (120)

RESINS

American Cyanamid Company (347)
Atlas Powder Company (126)
Carbide and Carbon Chemicals Corporation (355–356)
Haveg Corporation (94)
Hercules Powder Company (36–37)
Illinois Water Treatment Co. (8)
Reichhold Chemicals, Inc. (76–77)
Victor Chemical Works (53–54–55, 62–63–64)

ROTAMETERS

Laboratory Equipment Corporation (119)

RUBBER ACCELERATORS

Armour Chemical Division, Armour and Company (47)
Carbide and Carbon Chemicals Corporation (355–356)
The Matheson Co., Inc. (131)

RUBBER CHEMICALS

Aluminum Company of America (225–226–227–228)
American Cyanamid Company (347)
Armour Chemical Division, Armour and Company (47)
Carbide and Carbon Chemicals Corporation (355–356)
Emery Industries, Inc. (363–364)
Glyco Products Co., Inc. (68)
Hercules Powder Company (36–37)
Oronite Chemical Company (45)
L. Sonneborn Sons, Inc. (38)

RUBBER PRODUCTS, Industrial

The Pioneer Rubber Company (341)

RUBBER RECLAIMING CHEMICALS

Carbide and Carbon Chemicals Corporation (355–356)
Hercules Powder Company (36–37)
Socony-Vacuum Oil Company, Inc. (49)

RUBBER SOFTENERS

Carbide and Carbon Chemicals Corporation (355–356)
Glyco Products Co., Inc. (68)
Socony-Vacuum Oil Company, Inc. (49)
L. Sonneborn Sons, Inc. (38)
Standard Oil Company (Indiana) Chemical Products Department (72–73)

RUST PREVENTIVES AND REMOVERS

Carbide and Carbon Chemicals Corporation (355–356)
The Davison Chemical Corporation (59–60)
Socony-Vacuum Oil Company, Inc. (49)
L. Sonneborn Sons, Inc. (38)
Standard Oil Company (Indiana) Chemical Products Department (72–73)
Victor Chemical Works (53–54–55, 62–63–64)

SAFETY EQUIPMENT

Acme Protection Equipment Co. (216)
American Optical Company (208–209)
Eimer & Amend (20)
Fisher Scientific Co. (20)
Martindale Electric Co. (337)
Mine Safety Appliances Company (334)
The Pioneer Rubber Company (341)
Standard Safety Equipment Company (345)

SALT CAKE

American Cyanamid Company (347)
Reichhold Chemicals, Inc. (76–77)

SCALES, Industrial

Consolidated Products Co. Inc. (361)
B. F. Gump Co. (22–23)
W. M. Welch Scientific Co. (129)

SCIENTIFIC INSTRUMENTS AND SUPPLIES

Buehler Ltd. (328–329)
Central Scientific Company (58)
Consolidated Engineering Corporation (354)
Corning Glass Works (314)
Eimer & Amend (20)
Fisher Scientific Co. (20)

(Continued on page 410)

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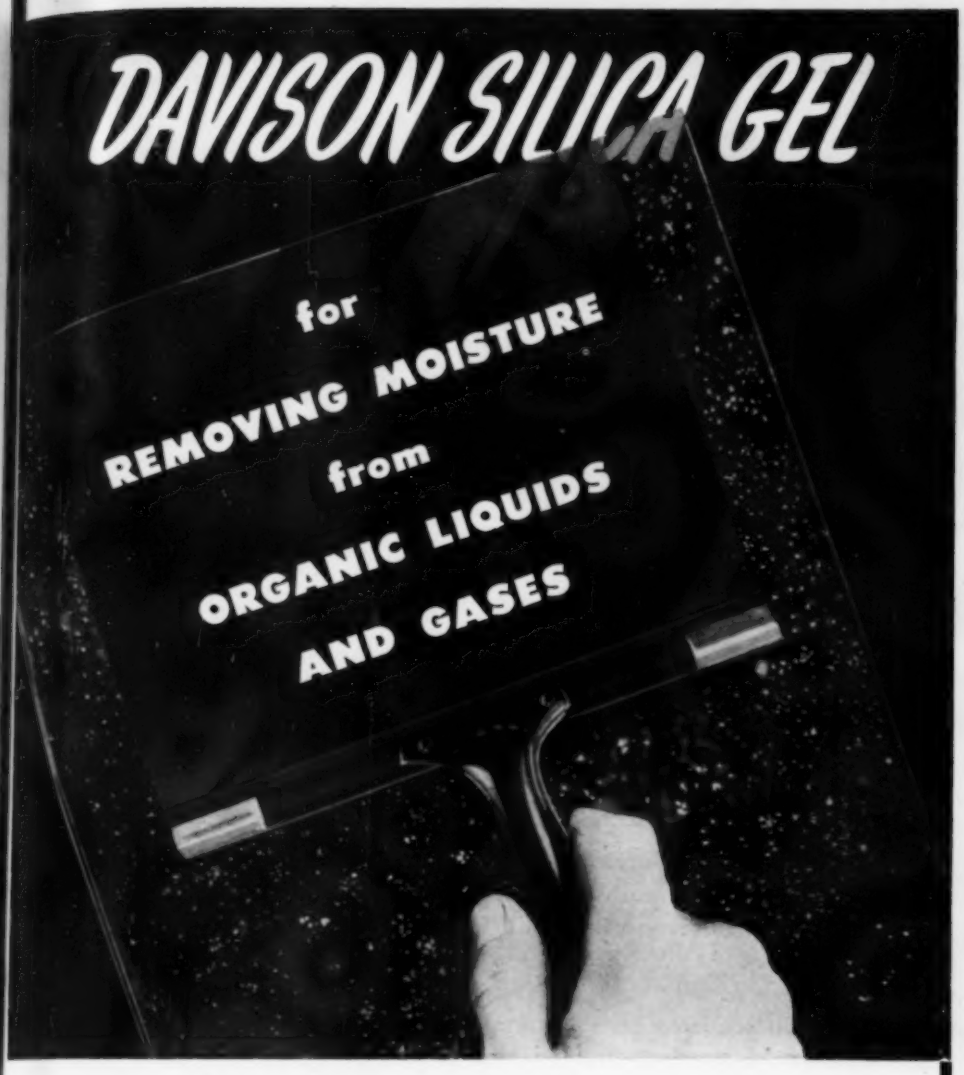
DAVISON SILICA GEL

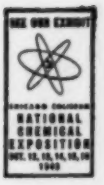


Practical and economical processes have been developed which employ the adsorptive qualities of Davison Silica Gel to reduce moisture content of organic liquids and gases. Such liquids or gases, as Benzene, Freon, Kerosene, Gasoline, Propane, Butane, etc., may be passed freely through Davison Silica Gel for drying to substantially zero water concentration. If you have a related dehydration problem, consult Davison.

THE DAVISON CHEMICAL CORPORATION

Progress through Chemistry

BALTIMORE-3, MD.



SILICA GEL

FOR EFFICIENT DRYING . . . EASE OF HANDLING . . .

Due to its tremendous surface area and inherent affinity for water, Davison Silica Gel will adsorb water from liquids, gases, and solids up to 40% of its own weight. The ease with which it may be handled is augmented by its physical strength, chemical inertness; the fact that it will not cake, channel or deliquesce, and that it is readily reactivated.

WIDE SELECTION OF PARTICLE SIZES

Davison Silica Gel is furnished in specific particle size depending upon the process and type of equipment in which it will be used. To determine the particle size best suited to your individual processes, you may depend upon the knowledge that years of experience have given the Davison Research Department.

DAVISON DESIGNS EQUIPMENT

Since many processes require custom-built dehydration equipment, the services of the Davison Engineering Division are available for specialized installations. They will cooperate with you in designing and manufacturing the equipment to meet your needs for efficient, economical drying of liquids or gases.

(Guide & Directory Page 43)

STOP COSTLY LEAKS

WITH THE NEW MODEL 24-101A

CONSOLIDATED LEAK DETECTOR

Process equipment of all types can now be tested for tightness—after fabrication, after installation, or during operation—with complete assurance of thoroughness. Leaks so small they would escape notice under other methods of testing can be detected and located with ease.

A new technique for leak searching has been tailored to the needs of the process industries. Equipment which cannot be evacuated conveniently needs only to be pressured with dilute or concentrated helium gas to be put under close scrutiny with the Consolidated Leak Detector. This method employs an ingenious hand-held Sampling Probe, which samples the atmosphere wherever a leak is suspected and feeds the sample to the Leak Detector for detection of any trace of helium.

This method of inspection is nondestructive and noncontaminating, and not limited essentially by factors of size, configuration, and construction.

For further information on the Consolidated Leak Detector send for descriptive bulletin, CEC-1801-X6.

LEAK DETECTOR DEMONSTRATION

See the Consolidated Leak Detector and other Consolidated instruments demonstrated at these two big meetings:

I.S.A. AMERICAN INSTRUMENT FAIR
Consolidated's Booth 226
Convention Hall, Philadelphia
SEPTEMBER 13TH TO 17TH

NATIONAL CHEMICAL EXPOSITION
Consolidated's Booth 354
Chicago Coliseum, Chicago
OCTOBER 12TH TO 16TH

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Analytical Instruments for Science and Industry
620 N. LAKE AVE., PASADENA 4, CALIFORNIA

EXHIBITORS Classified by Products CONTINUED

George E. Fredericks Company (206-207)
W. H. Kessel & Co. (120)
Arthur S. LaPine & Company (21)
Macbeth Corporation (109)
H. S. Martin & Company (80)
National Technical Laboratories (25–26)
Pfaltz & Bauer, Inc. (362)
E. H. Sargent & Company (125)
Schaar & Co. (31)
Scientific Glass Apparatus Co. Inc. (17)
Wallace & Tiernan Products, Inc. (342)
W. M. Welch Scientific Co. (129)
Wilkens-Anderson Company (111)

SCREENS, VIBRATORS, ETC., Industrial

Consolidated Products Co. Inc. (361)
The J. H. Day Company (229)
Denver Equipment Company (83)
B. F. Gump Co. (22–23)
Loeb Equipment Supply Co. (91-92)
The Ludlow-Saylor Wire Company (343)
Productive Equipment Corporation (344)
Simplicity Engineering Company (102)
Wallace & Tiernan Products, Inc. (342)

SEBACATES

Commercial Solvents Corporation (147)
The Matheson Co., Inc. (131)

SEPARATORS

Blaw-Knox Company (365–366)
Combustion Engineering Company, Inc., Raymond Pulverizer Division (69)
Consolidated Products Co. Inc. (361)
Denver Equipment Company (83)
Dings Magnetic Separator Co. (118)
Eriez Manufacturing Company (358)
Hardinge Company, Inc. (224)
Raymond Pulverizer Division, Combustion Engineering Company, Inc. (69)
Selas Corporation of America (88-89)

SEQUESTERING AGENTS

Alrose Chemical Company (313)

SILICA GEL

The Davison Chemical Corporation (59–60)
Socony-Vacuum Oil Company, Inc. (49)

SILICATES, Organic

Carbide and Carbon Chemicals Corporation (355–356)

SOAPS AND BASES

Hercules Powder Company (36–37)

SODA ASH

American Cyanamid Company (347)

SOLVENT RECOVERY CHEMICAL

Blaw-Knox Company (365–366)
Carbide and Carbon Chemicals Corporation (355–356)

SOLVENT RECOVERY EQUIPMENT

Blaw-Knox Company (365–366)

(*Continued on page 412*)

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Modern process technology requires varied materials to meet varied requirements. With Ceraware, Cerawite and Impervite, General Ceramics meets successfully the Industry's demand for all types of corrosion-proof and thermal shock resisting equipment. By providing all these material types from one source of supply, users get more than the inherent product advantages. Here are a few:

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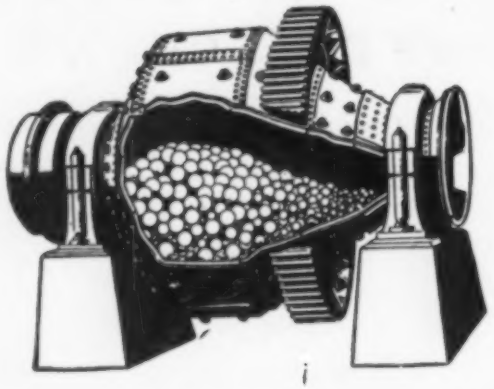
SAN FRANCISCO: 598 Monadnock Bldg.
SEATTLE: 1411 Fourth Ave.
TACOMA: 417 Tacoma Bldg.
MONTREAL: Canada Cement Bldg.
TORONTO: Richardson Agencies, Ltd., 454 King St., West
VANCOUVER, B. C.: Willard Equipment Ltd., 860 Beach Ave.

429

VERSATILITY
In Grinding



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- Open or Closed Circuit

The Hardinge Conical Ball (or Pebble) Mill is unequaled in efficiency. Grinds wet or dry, in open or closed circuit. Outstanding feature: natural size-segregation of grinding media, from feed to discharge. Bulletin 13-D.

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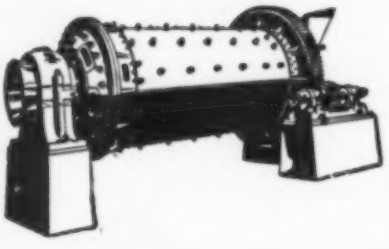

The Hardinge Convex-Head Rod Mill is ideal for producing minimum oversize when grinding in open circuit. Grinds either wet or dry. Convex heads reduce friction—prevent congestion of material at the ends. Rods are self-aligning. Ask for Bulletin 25-B.

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EXHIBITORS
Classified by Products
CONTINUED

Buflovak Equipment Division of Blaw Knox Co. (303–304–305)
Carbide and Carbon Chemicals Corporation (355–356)
Fansteel Metallurgical Corporation (137)
Glascote Products, Inc. (95)
The U. S. Stoneware Co. (40–41–42)

SOLVENTS
American Cyanamid Company (347)
Anderson-Prichard Oil Corporation (331)
Ansul Chemical Company (39)
Carbide and Carbon Chemicals Corporation (355–356)
Commercial Solvents Corporation (147)
Hercules Powder Company (36–37)
Socony-Vacuum Oil Company, Inc. (49)
Standard Oil Company (Indiana) Chemical Products Department (72–73)

SOLVENTS, Aromatic
Anderson-Prichard Oil Corporation (331)
Carbide and Carbon Chemicals Corporation (355–356)
Oronite Chemical Company (45)
Socony-Vacuum Oil Company, Inc. (49)
Standard Oil Company (Indiana) Chemical Products Department (72–73)

SORBITOL AND DERIVATIVES
Atlas Powder Company (126)
The Matheson Co., Inc. (131)

STEARATES
American Cyanamid Company (347)
Glyco Products Co., Inc. (68)
The Matheson Co., Inc. (131)

STEEL AND ALLOYS
By-Products Steel Co., Division of Lukens Steel Company (9–10)
Lukens Steel Company and Divisions (9–10)
Lukenweld, Division of Lukens Steel Company (9–10)
U. S. Steel Corp. (336)

STILLS—See Distilling Equipment

STYRENES
The Matheson Co., Inc. (131)
The U. S. Stoneware Co. (40–41–42)

SULFONATES
Alrose Chemical Company (313)
Hercules Powder Company (36–37)
The Matheson Co., Inc. (131)
Oronite Chemical Company (45)
Socony-Vacuum Oil Company, Inc. (49)
L. Sonneborn Sons, Inc. (38)
Standard Oil Company (Indiana) Chemical Products Department (72–73)

SULFONIC ACIDS
Alrose Chemical Company (313)
Armour Chemical Division, Armour and Company (47)
The Matheson Co., Inc. (131)
Standard Oil Company (Indiana) Chemical Products Department (72–73)

(*Continued on page* 414)

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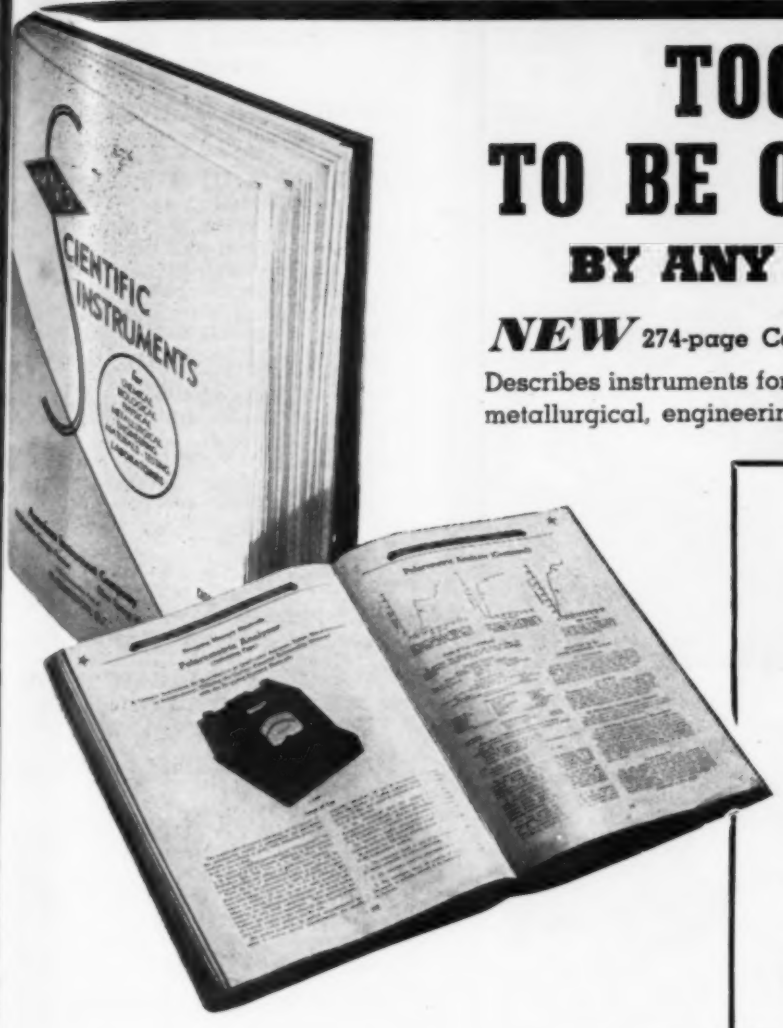

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*T. M. Patent Applied for by H. J. Hersey, Jr.

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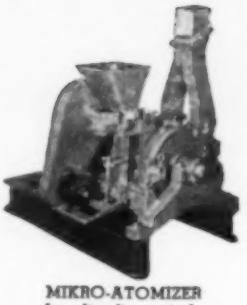
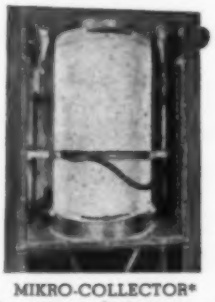


MIKRO-ATOMIZER
for ultra-fine grinds



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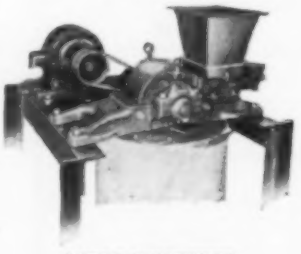
for optimum dust recovery



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EXHIBITORS Classified by Products CONTINUED

SULFUR AND DERIVATIVES
Ansul Chemical Company (39)

SURFACE ACTIVE AGENTS
Alrose Chemical Company (313)
American Cyanamid Company (347)
Armour Chemical Division, Armour and Company (47)
Atlas Powder Company (126)
Carbide and Carbon Chemicals Corporation (355–356)
Commercial Solvents Corporation (147)
Oronite Chemical Company (45)
Socony-Vacuum Oil Company, Inc. (49)
L. Sonneborn Sons, Inc. (38)
Victor Chemical Works (53–54–55–62–63–64)

TANKS
Aluminum Company of America (225–226–227–228)
Blaw-Knox Company (365–366)
Buflovak Equipment Division of Blaw-Knox Co. (303–304–305)
Consolidated Products Co. Inc. (361)
F. M. deBeers & Associates (115)
The Filter Paper Company (121–122)
General Ceramics and Steatite Corporation (114)
Glascote Products, Inc. (95)
Groen Mfg. Co. (33–34–35)
Haveg Corporation (94)
Heil Process Equipment Corp. (319)
Hercules Filter Corporation (117)
Loeb Equipment Supply Co. (91–92)
Mojonnier Bros. Co. (326–327)
The U. S. Stoneware Co. (40–41–42)

TANNING—See Chemicals, Leather

TANTALUM AND ALLOYS
Fansteel Metallurgical Corporation (137)
Pfaltz & Bauer, Inc. (362)

TOWERS AND PACKING
Blaw-Knox Company (365–366)
F. M. deBeers & Associates (115)
General Ceramics and Steatite Corporation (114)
Haveg Corporation (94)
National Carbon Co., Inc. (12–13)
The U. S. Stoneware Co. (40–41–42)

TRAPS, Steam
Haveg Corporation (94)

TUNGSTEN AND ALLOYS
Fansteel Metallurgical Corporation (137)
Pfaltz & Bauer, Inc. (362)

UREA AND DERIVATIVES
The Matheson Co., Inc. (131)
Reichhold Chemicals, Inc. (76–77)

VALVES—See Fittings

VARNISH AND BASES
Atlas Powder Company (126)
Hercules Powder Company (36–37)
Reichhold Chemicals, Inc. (76–77)

VENTILATING EQUIPMENT
American Air Filter Company Inc. (307–308–309)

(*Continued on page 50*)

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